THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1608.] LONDON, MARCH 6, 1894. [46TH YEAR. PRICE 6d.

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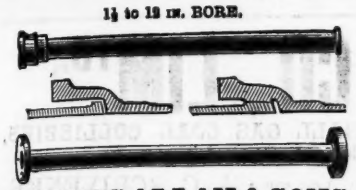

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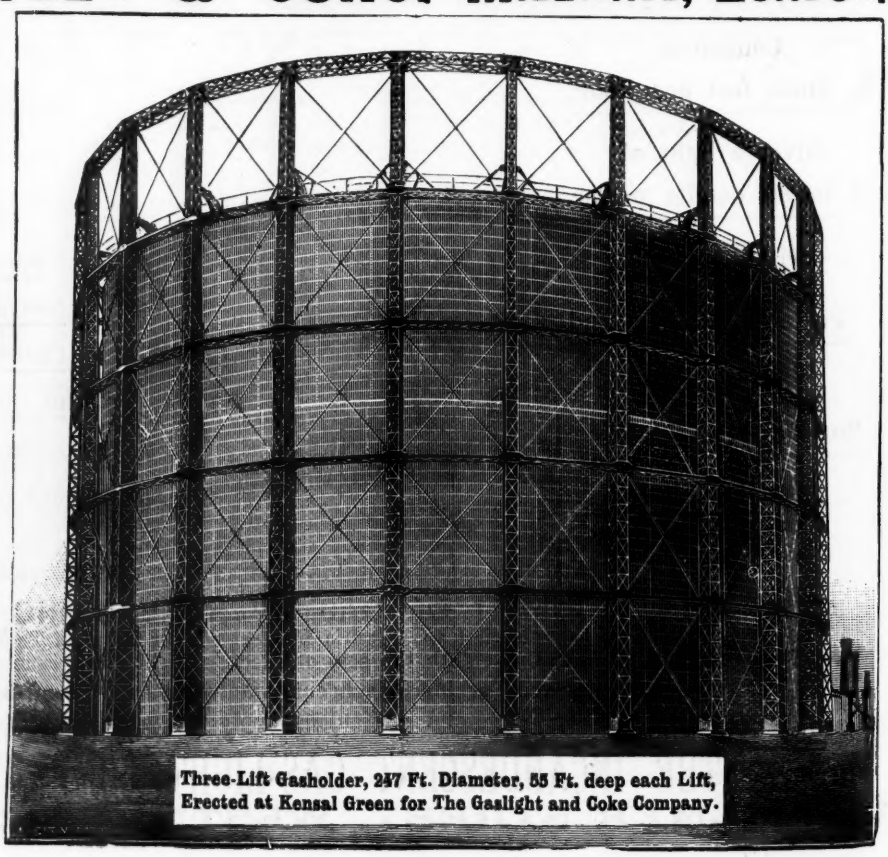

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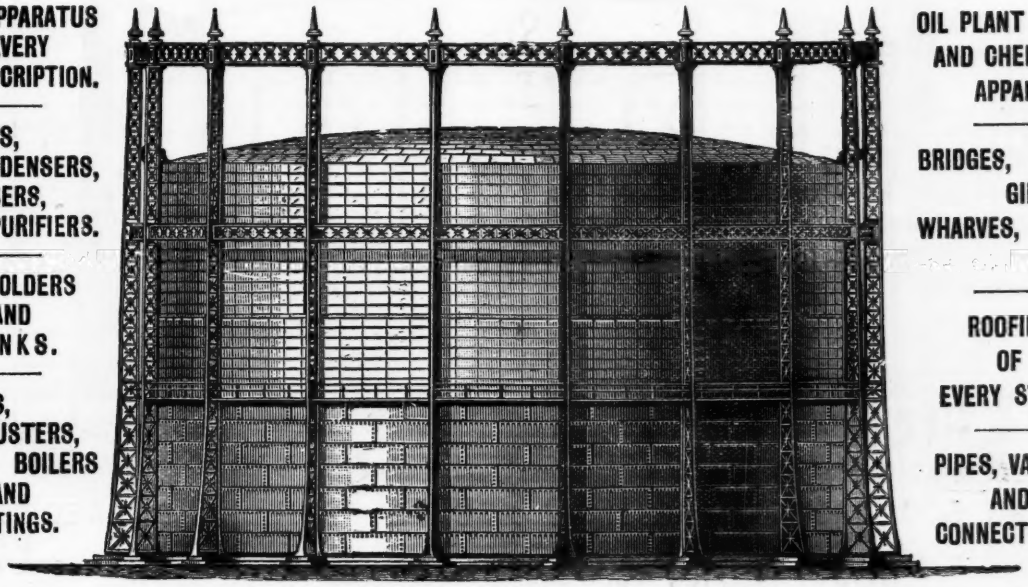

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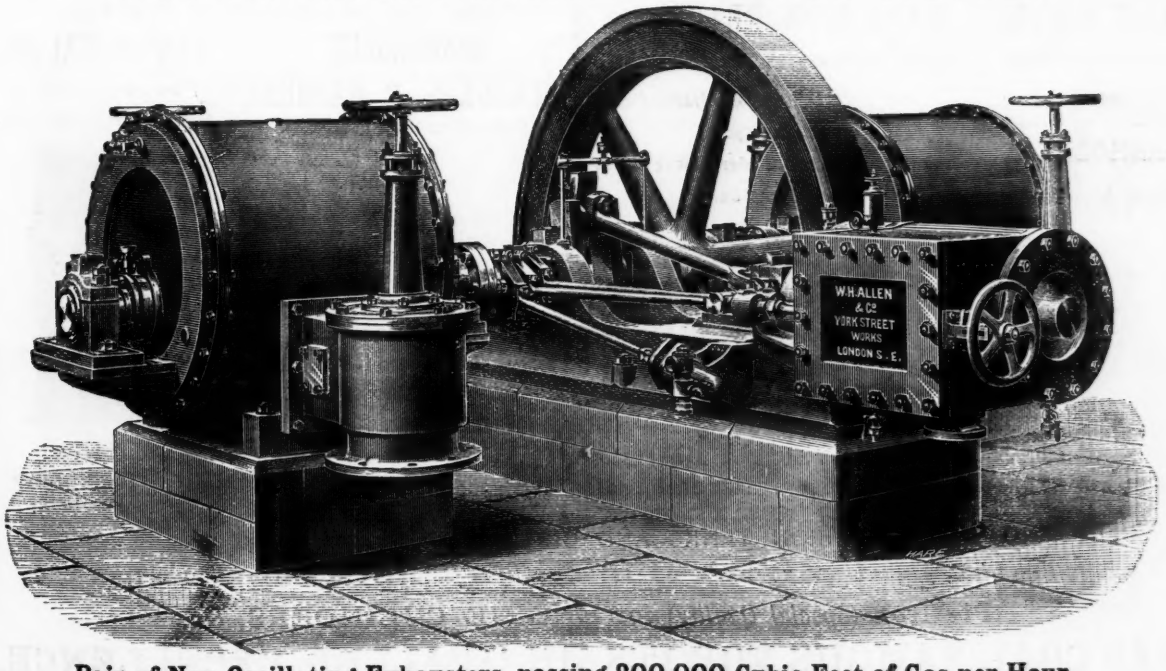

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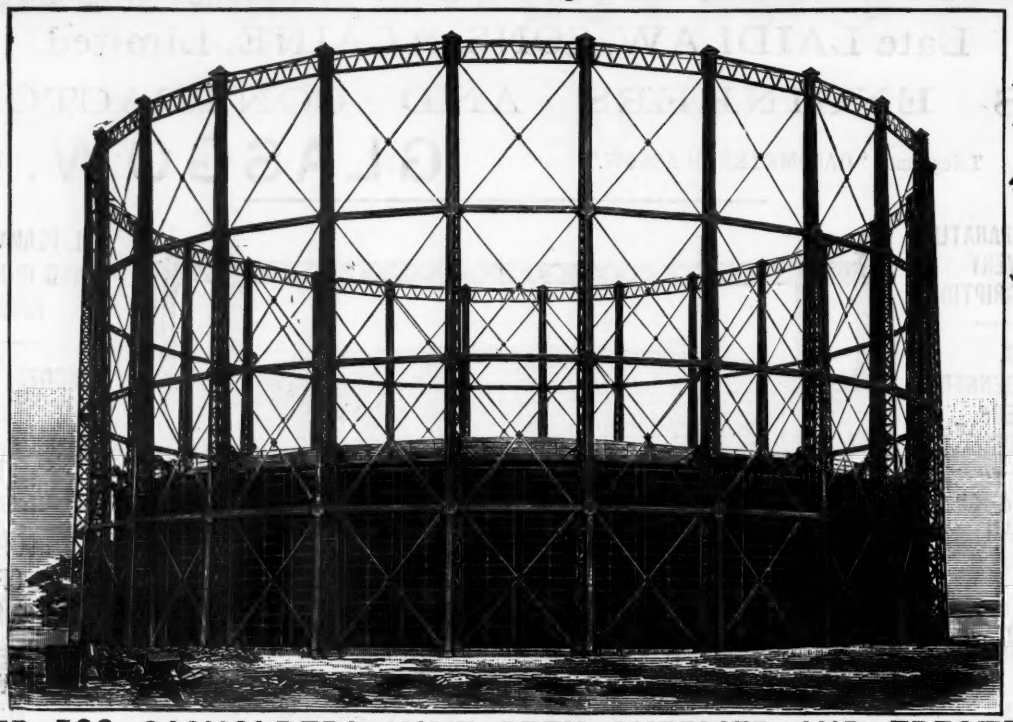

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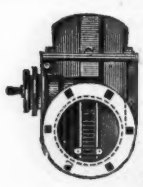

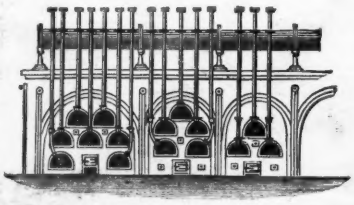

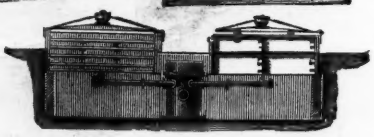

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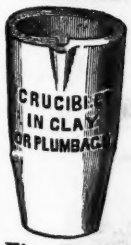

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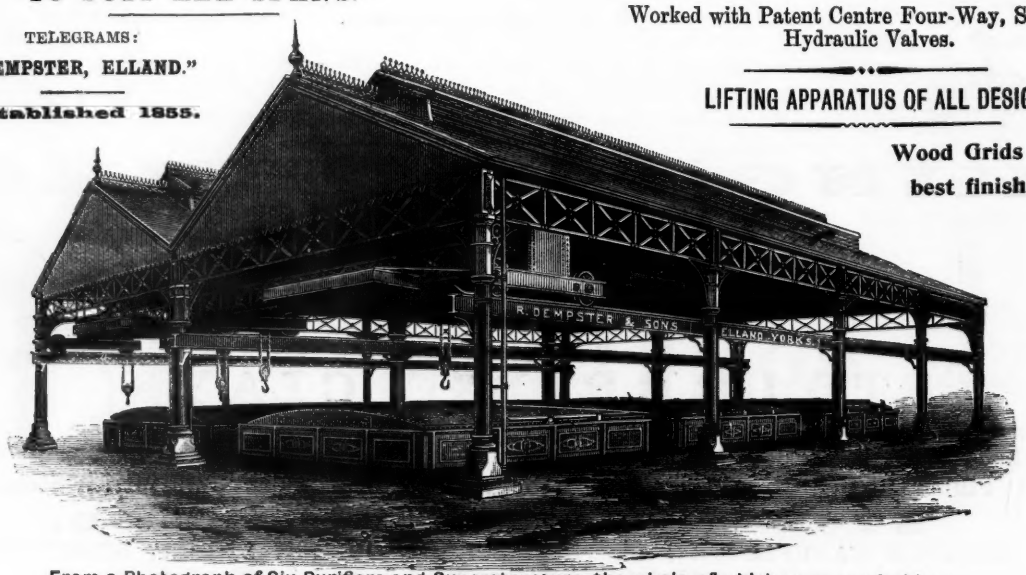

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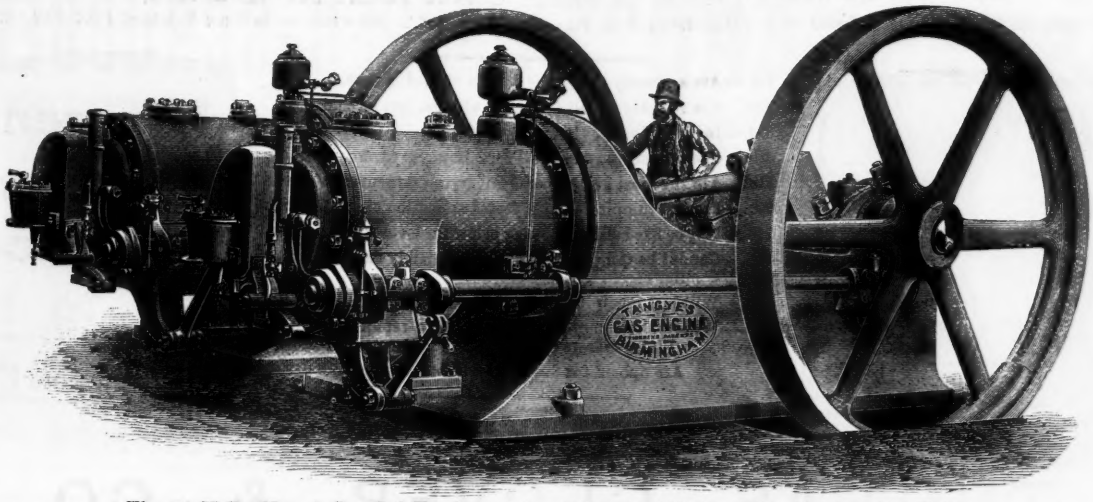

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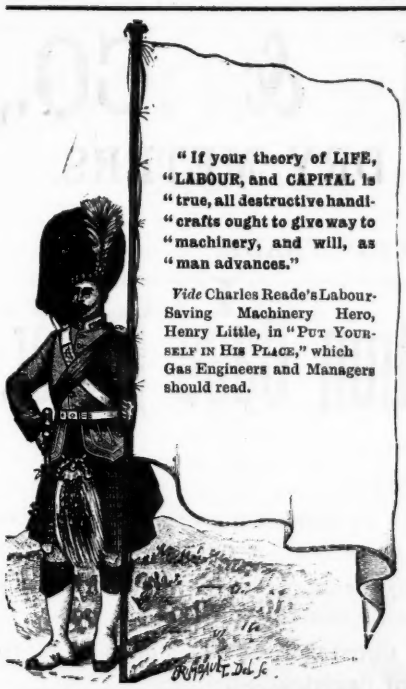

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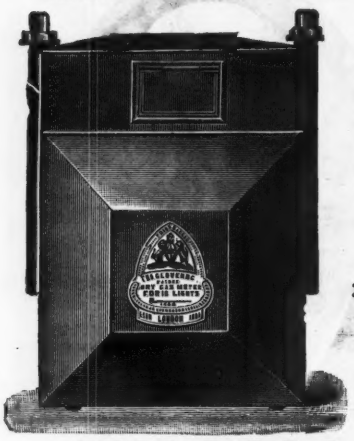

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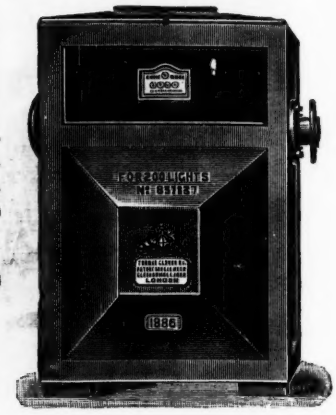

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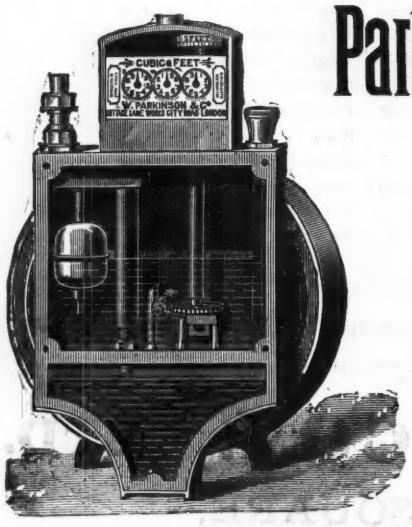

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THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TUESDAY, MARCH 6, 1894.

The Proposed Gas Undertakings Association.

THE very apposite letter of Mr. R. L. S. Badham upon the subject of the association of gas undertakings for purposes of defence, which appears in our "Correspondence" column to-day, is deserving of the attention of all who are interested in the higher politics of gas supply. The writer refers to the article upon the same subject published in last week's JOURNAL, in which the suggestion was treated in a general manner; and he gives several illustrations of the way in which gas undertakings are exposed to attack from unsuspected quarters. We can endorse all that he has to advance in this regard from our own experience of the necessity not merely for vigilance, but for vigilance carried to the extreme of inquisitive curiosity on the part of whomsoever would keep abreast of the scheming of Members of Parliament, even for the sake of learning the news of the day. If this is the obligation upon those who would simply know what is going on, how much greater is the need for incessant watchfulness by those who have something to defend!

Mr. Badham, in his letter to-day, cites the instance of the Rating of Machinery Bill, which was read a second time in the House of Commons last year; and this is certainly a good example of how a "gas interest" may be sprung into existence without warning. The Bill proposes to define such machinery and appliances as are not to be taken into account in valuing hereditaments for the purpose of rating. The second clause succinctly states that nothing in the measure shall be held to apply to the rating of water-works or gas-works. Why these properties are to be untouched by a Bill that would confer a benefit upon electric lighting concerns, is, as Mr. Badham observes, a mystery. But mark this. In the voluminous paper of "Notices of Motion and Orders of the Day," which contains the "order" for the adjourned debate upon the Rating of Machinery Bill, there appears an entry (against the name of Mr. Theodore Fry) of a notice of motion for Committee to "leave out clause 2." Then Mr. Badham mentions the Local Authorities (Acquisition of Land) Bill, which contains provisions to empower local authorities to purchase land by agreement or compulsorily for various purposes—gas-works being specially named. As our correspondent argues, if this Bill became law, it might possibly be held to sanction competition by a local authority in gas supply with a statutory company. But who would think of suspecting danger to Gas Companies in such a harmless-looking measure, which might be supposed, and even be intended, merely to facilitate the acquisition by local authorities of land for purposes to which they are already empowered to address themselves? An even more glaring example of a parliamentary ambush is that concealed in the Bill introduced by Mr. John Burns and a few others under the name of the Hours of Labour (Crown, &c., Servants) Bill. Who would ever think that a measure having such a title would possess the smallest, or most remote, bearing upon Gas Companies? Even when the print of the Bill is procured and scanned, it only appears on the face of it to be a "Bill to Limit "Labour in the Service of the Crown, of Local Authorities, "and of Railway Companies to Eight Hours a Day." It is only when the clauses are read that it appears to be the object of the proposed enactment to forbid Gas Companies, among other industrial concerns, to employ any person for a longer period than eight hours a day, or 48 hours per week, subject to a penalty of £50 to be incurred by the general manager of any company convicted of contravening this eminently fair and reasonable provision. The two last-named Bills have been dropped. This is the sort of thing which a Gas Undertakings Association would look after, and which, indeed, ought to be looked after by some body or by some organization having eyes sharpened by a legitimate interest; for, although it might be urged that Parliament would never stultify itself by consenting to such monstrous projects of legislation as the one last named, yet it can never be known what mischief might be wrought by a small, innocent-looking Bill slipped through Parliament while nobody is watching.

We have only one word to utter in reference to Mr. Badham's criticism of the observation in our article respecting the historic termination of the original identity of Gas and Water Companies' interests. We fully admit that in many respects these interests are still identical. It is possible to speak of gas and water supply in the same breath, with relation to some aspects of the two interests; and the enemies of private enterprise in regard to the supply of the necessaries of life to town populations not infrequently try to kill the two birds with one stone. If for this reason alone, Gas and Water Companies can never be antagonistic to one another. All the same, modern legislation has gone far to place the two interests upon a different footing. The fact cannot be gainsaid that gas is a manufactured product, while water is not, except it is so called by a figure of speech introduced to convey a sense of its being collected, purified, and distributed by art. This is sufficient reason for treating the two interests separately.

Mr. Braddock's Address to the Manchester District Institution.

THE Manchester District Institution of Gas Engineers met last Saturday, when the President (Mr. James Braddock, of Radcliffe) delivered the Inaugural Address which will be found in another column. As might be supposed, the first topic of interest that suggested itself to Mr. Braddock as calling for mention on this occasion was the coal strike and its effects upon the gas undertakings of the district which has Manchester for its centre. The President had nothing to say about the strike itself beyond

noting as its two redeeming features the "heroic fortitude "displayed by the men and their families in their "poverty," and the reference of the issue to a Board of Conciliation. He went on to remark that to coal gas makers the main question presented by this historic affair is as to how the consequences of a possible repetition of such a disturbance in the coal trade can be provided against. The most obvious answer to the question is, of course, the conclusion that gas undertakings must hold larger stocks of their raw material than have hitherto been regarded as necessary, and must be content to put up with whatever countervailing inconveniences this plan may entail upon them. Unlike many—perhaps the majority—of gas-works administrators, Mr. Braddock holds that it is preferable to put by a definite store of coal to be kept untouched against an emergency, rather than to work the whole out year by year. He says upon this point: "In the former case, there will come in operation "a decremental rate of loss, being less in the aggregate "over a series of years than the sum of the losses taking "place from an equal quantity of fresh-wrought coal." In this he is probably right, supposing that the permanent store is well housed. The loss of quality from a large bulk of gas coal put away dry in a weather-proof house cannot be great; and this principle of "magazining" coal, as it may be termed, for the sake of distinction from the system of coal heaping, may be expected to commend itself more and more to gas managers, when it is once understood that the charge on the capital represented by the emergency stock is of the nature of insurance. After all, the cost of keeping three months' supply of coal, calculated on the mean Lady Day or Michaelmas requirement, would not, in the case of an ordinary gas undertaking, be a very serious matter. Large undertakings must supplement such precautions of this kind as physical considerations permit, by prudently distributing their contracts over districts shown by experience to be not liable to simultaneous disturbances; and, after all, there is the resource of getting out of a coal difficulty by payment. With regard to the possibility of making British gas undertakings independent in some degree of coal, by the various means now being tried to this end, Mr. Braddock's naive confession that the periodical literature of the subject is "as entrancing as a novel," is susceptible of a much wider interpretation than the speaker possibly intended it to convey to the minds of his hearers. It may be truly said of this kind of technical literature that it is not merely a "novel," but is even describable as a "serial story," inasmuch as to every instalment of it might be appended the familiar legend "To be continued," and the *dénouement* is always just a little farther on. The bulk of Mr. Braddock's address is composed of valuable observations and "wrinkles" produced from the author's own experience, which has been extensive. His idea of testing mains for leakage when the minimum consumption is going on is, of course, not original; but the object is one to be sought for as a regular part of the routine work of distribution. There have been few better addresses than this of Mr. Braddock inscribed in the Transactions of any District Gas Managers' Association.

The Effect of Hot Weather on the Lighting and Eating Trades.

When the Governor of the The Gaslight and Coke Company told the assembled proprietors, at the last general meeting of the Company, that the gas consumption of London had fallen off by reason of the exceptionally bright weather of the past year, the *Standard*, with a ponderous affectation of superior wisdom altogether in keeping with the traditional reputation of this highly respectable newspaper, solemnly pretended to "wink the "other eye" over the explanation, and asserted that it was altogether insufficient to account for the fact. It is by no means an unusual thing to find a newspaper writer assuring the world that he knows the reasons for everything far better than do the specialists who occupy themselves in the various matters that from time to time make news to be recorded and commented upon in the public Press. He is a poor scribbler indeed who cannot (on paper) fight an ironclad, lead a division of cavalry, manage a Government department, conduct a State ceremony, try a criminal, or administer an industrial undertaking, according as the exigencies of the sub-editor's demand, and do all in a style superior to criticism. When the official head of the largest Gas Company in the kingdom declares that the business has suffered from fine weather, it is therefore only in the way of the omniscient journalist to "pooh-pooh" the statement. He knows much better. It is not incumbent upon him to show why his knowledge should be so exact, comprehensive, and reliable. It is enough that he scorns the supposition that an extra hour or two of sunlight during so many days can have the slightest effect in enabling the people who experience it to burn less gas. Yet, in a recent issue of *The Times*, the extraordinary warmth of last summer is brought forward to explain a very much more distant effect—being no other than a striking reduction in the consumption of butchers' meat for the season. Why did 1893 take 161,000 tons less meat than 1892? The reason offered by Mr. H. Kains-Jackson, of Chiswick, is simply that "in 1893, two "hundred days of hot weather took away one ounce per "diem of the normal appetite of 38 millions of a flesh-"eating people. This one ounce off a full meat ration "would account for minimizing the butchers' bill by the "161,000 tons." After this, the gas and electric light purveyors who complain that what the Chartered report spoke of as the "phenomenal"—meaning the exceptional —weather of 1893 spoiled their business to some extent, may be allowed to use language of truth and soberness.

Facts and Fallacies about Street Lighting.

There can be no objection of a general kind to the style of self-advertisement practised by professional gentlemen who, like Professor Henry Robinson, happen to have a nice little electric lighting job in hand, at the expense, or rather by the complaisance, of organizations such as the Society of Arts. It is understood to be unprofessional for consulting engineers and electricians to advertise their capabilities in the newspapers. But civilization has other resources open to them; and the demand for papers by more or less learned societies, gives these gentlemen not the least convenient opportunity for publishing ingenuous disclosures of their own cleverness. Some men who might be named are quite artists in making the same subject-matter up into a great number of forms. French cookery is nothing to it. They hunt the "bubble reputa-"tion," not exactly in the "cannon's mouth," but over a course of lecture platforms; and there is an unwritten understanding among them for the supply of the needful "discussions" by a stock company of ready speakers. Thus it invariably happens that, whenever Mr. White gets a chance of describing his little parish undertaking, Mr. Brown attends and speaks—not on the paper, which is not expected of him after the first three or four hearings—but of his own little experience in the North of England; and Mr. Black has a "turn" for expatiating upon the utilization of the enormous power of Niagara. There is great honour among these various gentlemen; and they really play their respective parts with a degree of seriousness far beyond that at the command of the Roman augurs, if the scurrilous tradition respecting the latter is actually to be credited. No matter how many changes are rung upon the well-worn themes, Mr. White never fails to lend the encouragement of his presence to Mr. Black and Mr. Brown, when it happens to be their turn to occupy the platform; and so the various Societies' journals are padded out to the desirable degree of corpulence, and the world is kept in remembrance of its benefactors. It is all very nice, and, as already remarked, in a general way there is no objection to the system; but when a lecturing gentleman takes too much credit to himself and his friends, he must expect to be pulled up sharply. There was not much in Professor Robinson's Society of Arts paper on the St. Pancras electric lighting venture; but the author said something not quite correct about street lighting. He remarked that "the present "lighting of the thoroughfares in the Metropolis is a "reproach," which is true enough, and has been said by gas engineers the past twenty years. He then proceeded to claim that "St. Pancras has led the way in reforming "this"—which is absurd. If St. Pancras had been the first parish to experiment with arc lighting, there might have been some sense in the observation; but as it is, even the electrical journals, and the experts who, like Mr. A. P. Trotter, have studied the subject, freely admit that the lighting of Whitehall Place and Hyde Park Corner by gas surpasses everything that has yet been done by electricity at vastly greater cost. Belfast, Birmingham, and many other places, can strengthen the case for

street lighting by gas; so that if Professor Robinson thinks that St. Pancras has done anything noteworthy in the way of street lighting by putting up a few arc lamps along some second and third class thoroughfares, he has a good deal to learn of what is going on in the world outside this pet parish of his. London street lighting is generally bad, we admit; but this is simply because the authorities who have to pay for it think the bill heavy enough as it is. Yet there are parishes, even in poor and dingy South London, where as good public lighting as could be desired for all practical purposes may be seen every night. There is nothing flashy about these examples. But then they do not cost nearly so much as the St. Pancras show; and the ratepayers have the comfort of knowing that when they have paid the Gas Company their responsibility ceases. There is no demon of unrest by name Depreciation or Loan Repayment to sit on the pillow of a South or East London vestryman. We doubt if Professor Robinson himself knows what the St. Pancras electric lighting costs, "all in;" and it is pretty clearly the object of the parochial authorities to keep such information from the public as long as possible.

Side Lights upon Company Promotion.

The ways of company promoters are apt to be regarded by the rest of the world as peculiar; but two illustrations that have recently come under our notice show that some company-mongers do their business in an exceedingly simple style. The first of these instances is that supplied by some artless individuals who are interested in a system of burning town refuse for steam raising, the effect of which is asserted to be the reduction of the cost of electric lighting to a point where gas ceases to be a serious competitor. These people exhibited their device in action at some works in Halifax a few days ago; and they actually invited a large party of "Press representatives" from London to see the show—treating their visitors, of course, in the regulation fashion, to the "chicken and champagne" that are such renowned agents for soothing the savage breast of the average reporter sent to do a notice of something which he knows nothing whatever about. The little excursion must have cost a considerable sum; and it was duly paid for by a sheaf of "Press notices" of all sorts. The more untechnical the writers, the more enthusiastic their testimony. The gentleman who represented the *Woman's World* on this occasion was quite sure that the "Livet system," as it is called, of making electric light from dustbin refuse is an invention calculated to completely revolutionize the scavenging arrangements of our great towns; and the lady who acted as Special Commissioner for the *Sporting Mirror* voted Mr. Livet a greater man than poor dear old Mr. Watt, who invented the steam-pump or something or other in the same line. Such are the commentaries of an enlightened Press on a matter of mechanical engineering; and it is upon such recommendations, when served up in a prospectus, that the still more enlightened general public are asked to subscribe their money! We did not go to Halifax to see this wonderful display; but we are quite ready to accept the judgment of our esteemed contemporary the *Electrical Review* on the affair, which is that "the demonstration was "little short of an extravagant farce."

The other illustration of modern financial practice to which we have alluded came out in the course of the examination in bankruptcy of a gentleman who admitted having been engaged in endeavouring to float a Company for the purpose of purchasing from himself an estate abroad to which his title was not so clear as he could have wished. A certain financial newspaper got wind of these proceedings, and sent him an advance copy of an article denouncing the proposed venture, with an intimation that "for a consideration" the article would be suppressed. The blackmailers succeeded in getting from their victim a post-dated cheque for £200; and the article did not appear. When the cheque was presented, however, it was dishonoured. One hardly knows which party to admire the more in this beautiful operation. The story contains a whole magazine of morals for the edification of such as dabble in "wild-cat" speculations, and pin their faith to what they read in the financial newspapers in commendation, or the contrary, of such ventures. The marvel is that so many of that class of journals still exist, after the numerous exposures of the venality of the tribe to which the public have been treated.

WATER AND SANITARY AFFAIRS.

The London County Council have, as we quite expected, endorsed the entire report of their Special Water Committee, and have made the situation so much the worse by adding as a further condition to the proposed negotiations, that "no monopoly right on the part of the Water "Companies be recognized." As the Companies are not quite bereft of their senses, it is not likely that they will forthwith surrender the key of the position by declaring that the field is open to everybody, and that all their invested capital is based upon a mere illusion. However dexterously Mr. Cripps may deal with this subject—threading his way through a maze of technicalities to prove that the Companies have no statutory defence against a competing supply—the common sense and practical experience of the Council's Chief Engineer, Mr. A. R. Binnie, find expression in some conclusions which seem largely at variance with the subtle theories of the Parliamentary Agent. Having declared that the time has now arrived when the Council must frame for their guidance a definite policy on the question of water supply, Mr. Binnie goes on to show in his report how the experience of all past parliamentary procedure leads inevitably to the conclusion that in no single instance has Parliament permitted the acquisition by any municipality of the rights of water supply, without in the first instance proper arrangements having been made for the purchase of the companies' undertakings upon terms fair and reasonable to both parties. Proceeding to consider the attitude which the Council should adopt towards the Bills that three of the London Companies are bringing forward, and especially two, Mr. Binnie remarks that mere opposition to the applications of the Companies by the Council "must be followed by certain and ignominious defeat." The reason given for this conclusion is rather racy—being found in the circumstance that the whole drift of the evidence placed before the Royal Commissioners by the witnesses for the Council went to show that London requires more water and extended works. If, therefore, the Companies are to continue to perform the duties imposed upon them, further powers of some kind "must be conferred."

Having thus stated the dilemma, what is Mr. Binnie's way out of it? After patting the Council cleverly on the back, by speaking of their "prudence, business capacity, "and determination," he submits that the time has now arrived when some serious effort should be made by the Council to acquire the undertakings of some of the Water Companies, and to prepare for carrying on the work now performed by them until the Council shall be in a position "to afford to the large community which it represents a "proper and efficient supply of water." This is just exactly a point to be guarded. For the Council to buy "up some of the Water Companies" would be a piece of strategy fraught with confusion and mischief. It happens that the recommendations of the Special Water Committee, adopted by the Council last week, comprehend all the undertakings, and cover the whole water supply of the Metropolis. So far the proposal is a right one, though it has a fringe which makes it hopeless. Mr. Binnie clearly perceives the engineering difficulty. If what he means by "a proper and efficient supply" is to be introduced, necessitating an entire change of source, there must yet be an intervening period of ten or fifteen years during which the existing sources must be relied upon. How is the interregnum to be bridged over? Mr. Binnie's notion is that the Council must somehow intervene. But the Council are taking no practical step for the purpose. They talk of negotiating with the Companies with a view to a general purchase of the undertakings. But everybody knows all this will come to nothing. The next step talked about is to secure compulsory powers of purchase by an Act to be obtained, if Parliament will grant it, in 1895. In the meantime, is Parliament to throw over the Bills of the Water Companies—especially the East London, and the Southwark and Vauxhall—on the faith of a promise from a shifting body like the County Council? Unless Parliament realizes the state of the case, and does its duty towards the Metropolis, there is danger lest, the Companies being refused the requisite powers, and the Council continuing impracticable, the water supply will really run short somewhere. Parliament has before now allowed itself to be misled by the County Council; and if it falls

into the same error in the coming session, matters may become serious. The question of the Metropolitan Water Supply seems verging on a *fiasco*.

In the course of the County Council debate on this subject last week, Lord Farrer, while surveying the situation with a considerable amount of anxiety, approved the idea of approaching the Companies with proposals for purchase, because it would place the Council in a better position for opposing the Bills which the Companies are now bringing forward. This is at least ingenuous; and it is to be hoped the Companies will take the hint, so as to let Parliament know in due time that the proposed negotiations cannot be entertained, seeing that they are compassed with conditions to which it is impossible to submit. Lord Farrer, despite his admirable advice, is shrewd enough to say he does not expect that the negotiations will do otherwise than fail. In other words, the attempt will simply serve to throw dust in the eyes of Parliament. But allies are to be sought, anywhere wherever they can be found, so as to strengthen the hands of the Council in fighting the Water Companies; and for this purpose an amendment proposed by Lord Monkswell was adopted. What good will come of all this nobody can tell, except it is supposed that in some way the Companies will suffer damage. At the same time, we are not sure that the Council have made themselves safe.

The Management of the Bromsgrove Gas-Works.—Mr. Alfred Bird, assistant at the Cradley Heath Gas-Works, has received, out of 130 applicants, the appointment as Manager of the Bromsgrove Gas-Works, which was advertised in the JOURNAL on the 20th ult.

The Salary of the Chief Engineer of the London County Council.—At the meeting of the London County Council last Tuesday, the salary of the Chief Engineer (Mr. A. R. Binnie, M.Inst.C.E.) was increased from £1500 to £2000 per annum, by two annual increments of £250. An unsuccessful attempt was made to have the matter deferred for six months.

Sea Water for Fire Extinction.—Salt water mains in the "conflagration district" of Boston (Mass.) are proposed as an auxiliary to the existing water-works lines. The estimates for the work have been prepared by the City Engineer (Mr. W. Jackson), and they provide for 16,800 feet of 12-inch pipe and the necessary hydrants, at an expense of approximately $50,000. It is expected that the fire-boats will be able to force a supply of from 8000 to 10,000 gallons of water per minute through these pipes, as is done at the present time in some of the cities on the banks of the Great Lakes, and thus furnish water for from 30 to 40 fire-streams.

Books Received.—"Betterment, Worsement, and Recoupment." By Arthur A. Baumann, B.A., Barrister-at-Law. (London: Edward Stanford, Cockspur Street, S.W.) This little work is the author's "Betterment" re-written, as he says, "by the light of extended knowledge." It consists of four chapters only with a note on "Betterment in America." Small as the book is, it deals with a large subject; and therefore it merits more than the present brief notice.——"Spons' Architects' and Builders' Price Book, with Useful Memoranda and Tables." By W. Young. (London: E. and F. N. Spon, 125, Strand.) Times change, and prices change with them; and this necessitates a comparatively frequent re-issue of Messrs. Spon's price book, the 21st edition of which has recently appeared. The continual addition of new subjects has brought about the abandonment of the pocket-book form in which the matter was formerly presented, and the adoption of the usual shape. The present edition contains a chapter on electricity, with complete specifications and estimates of some electric lighting installations carried out by the author; and also extra divisions on concrete, fireproof floors, and granite.

Electric Lighting in Brussels.—It was a long time, as our readers may remember, before the Municipality of Brussels made up their minds on the subject of having an installation of electric-lighting plant; and now that the Company to whom the work was entrusted have completed the necessary arrangements for the supply of current, customers are a little shy of applying for it. At all events, according to a Brussels correspondent, they have not rushed in crowds to obtain it; and for a very good reason. The selling price is 10c. per hectowatt, with a reduction for a large quantity; and it appears that when the proprietors of the principal cafés, who had been among the first customers, came to count the cost after a fortnight's lighting, they were so alarmed at the amount that they switched off the electricity and turned on the gas, which competes very advantageously with its rival, not only in regard to price but in intensity, when burnt in the most modern appliances. The Brussels Café and Hotel Keepers' Society have petitioned the Council for a reduction; and they say they will make terms with private companies if their request is not granted. It will thus be seen that the worthy citizens are not so enamoured of their municipal electric lighting scheme as to support it at a monetary sacrifice.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 452.)

THE occasional fits of dulness affecting the Stock Markets which we noted last week also characterized the opening of the week just closed; but, as it progressed, the tendency became more settled, and nearly every department exhibited a disposition to rise. The chief feature was still the demand for unexceptionable investment securities; and, under the influence of a strong demand, Goschens rose, until on Tuesday they actually changed hands at 100⅝—a price probably never contemplated by the most sanguine. In their train they drew up with them everything of sound character; and, at a respectful distance, second-class stuff followed their advance. The cheapness of money, of course, lent a helping hand. Apart, however, from the choicer securities, the general tendency was good, although towards the close there was some disposition to halt awhile, and await indications of future developments. The settlement was passed through without difficulty; and the Money Market eased down considerably when Stock Exchange requirements no longer created a demand. The Gas Market was very quiet at first, but soon revived, and remained brisk to the close. The general tendency was very firm; and several quotations have made moderate advances. In Gaslights, the "A" began rather uncertainly; and the quotation was put down on Tuesday. But it very speedily rallied, and, after some smart dealing, closed at an advance of 1 on the week's balance. Little was marked in the secured issues; but one or two of them have risen in price. South Metropolitans were only moderately dealt in, and may be written firm; the *ex div.* variations showing nothing more than fractional differences either way. Commercials did not all the week change hands, though both of the issues are quoted higher. Many of the Suburban and Provincial Companies were marked *ex div.* last week; and all show a disposition to improve, in addition to which British has made a substantial advance. The Continental undertakings are quieter, but firm generally; and Imperial has recovered another point. None of the rest exhibit any feature of particular interest. Some of the Water Companies show a slight falling off in value, induced possibly by the attitude of the London County Council, at which, however, shareholders need not yet take fright.

The daily operations were: Quiet business in Gas was the rule on Monday; and the tendency generally was not of the best. Commercial new rose 1½; and Melbourne bonds, 1; but Imperial Continental fell 1. In Water, Grand Junction receded 1; and Southwark, 2. Tuesday's business was very slight; and again there was a dubious tendency. Gaslight "A" fell 1; though Bristol and British rose 1 each. Wednesday brought a rally in Gaslights; and the "A," "H," and "J" gained 1 each. This was accentuated on Thursday by a further advance of 1 in Gaslight "A," and the like in Imperial Continental. Friday again was a bright day for Gas. Commercial old rose 2; and British and Imperial Continental, 1 each. Water was easier—Grand Junction falling 1; and West Middlesex, 3. Saturday was fairly busy; but quotations underwent no further change.

ELECTRIC LIGHTING MEMORANDA.

Conference upon Electric Traction Regulations—The Condition of the Subsoil of Towns—Testing the Presence of Gas in Street-Boxes and Manholes.

THE event of the past fortnight for electricians has been the conference held at the Board of Trade offices, under the presidency of Sir Courtenay Boyle, upon the proposed regulations of the Department for electric traction. The Chairman stated, in opening the proceedings, that the meeting was called to discuss regulations in clauses which are in certain Bills, and which it is in contemplation to insert in all Bills as model clauses. The draft of these regulations has been issued by the Department and taken into consideration by several interested bodies; and a glance at it, with the suggested alterations, as published *in extenso* in the *Electrician* on the 23rd ult. shows, among other things, the extent to which the railway companies, the water companies, as well as the municipal corporations have associated themselves for united effort after the fashion now suggested for statutory gas undertakings. The only gas undertaking represented at the conference was The Gaslight and Coke Company, who sent Messrs. Monier-Williams, Field, and Foulger to support the formal observations respecting the scheme of regulations which they had submitted in writing. This statement showed that the regulations did not contain any prohibition of connections of electric wires with gas-pipes, and expressly permitted such connection with a water-main under certain conditions. The Company suggested that the Board should reconsider this matter, and also the question of uninsulated returns in the Metropolitan area. Attention was likewise drawn to the limitation of protection against injurious affection of gas and water mains to cases of fusion and electrolytic action; and the suggestion was offered that this is not enough. It was further pointed out that the regulations provided only a single penalty, with a further daily penalty in case of continued offence; and it was suggested that, in the absence of any provision as to

damages, electrical traction undertakers might risk the imposition of a penalty, and purchase practical immunity thereby. In bringing these considerations forward, The Gaslight and Coke Company deserve well of the gas industry. The Board of Trade will consider the suggestions made in regard to the matter of the regulations; and as to earth connections, the conference accepted a compromise offered by Major Cardew, to the effect that no portion of an earth connection shall be placed within 6 feet of any pipe less than 3 inches in diameter, unless with the consent of the owner, except a main for water supply; such consent not to be unreasonably withheld.

One portion of the "Memorandum" submitted to the Board of Trade by The Gaslight and Coke Company in connection with the matters dealt with in the previous paragraph may be commended to the attention of electricians and others who may flatter themselves that the trouble and responsibility arising out of street explosions may be placed wholly upon the owners of gas-mains. This statement shows that in many, if not in most, streets in the Metropolis the subsoil is crowded with mains and works of gas, water, electric, hydraulic, and other companies, and of sewer authorities. Among other inconveniences, "too obvious to need comment," this state of things results in great liability to frequent subsidences, the formation of cavities (sometimes of great extent), and frequent leakage of gas-mains. These subsidences, cavities, and leakages are for the most part undiscoverable, and not to be prevented by any possible precautions, and often are discovered only after injurious consequences have arisen. Explosive mixtures are liable to be formed in these cavities and in sewers, particularly the numerous disused sewers; so that frequently the gas travels long distances from the seat of the original mischief. What is true in this respect of the Metropolis, is also true of many cities and towns throughout the country. Roads are made up, paved, and necessarily left to settle, which is a process that often goes on for a quarter of a century or even longer, according to the depth and the nature of the filling material used. Gas-mains have to be placed in such thoroughfares; and is the gas company alone to be held answerable for all that may happen to these roads in regard to underground leakages of gas? Frequently, in order to trace out the genesis of a subsoil trouble of this character, a regular "house that Jack built" process of ratiocination would have to be gone through. As it is, the gas undertaking has to bear more than its due share of risk in connection with street explosions. British juries are not much given to ratiocination; and when a gas-main is proved to have leaked, and somebody has suffered in consequence, the gas company generally has to pay the damages. It is asking too much of them, however, to require their contented submission to the additional injury and obloquy which electric lighting companies would fain put upon them whenever the lid of a street-box is blown into the air as the result of action between an explosive gaseous mixture and an electric spark.

Commenting upon the subject of street-box explosions, our contemporary the *Electrician* says, in a recent issue, that careful inspection of manhole boxes is at present the only sure preventive of such catastrophes. Naturally, the suggestion is put forward that "the onus of making such inspection, as well as the responsibility for explosions, should they occur, might be thrown on the real culprits, the gas companies, who ought to be thankful for the opportunity thus afforded them for obtaining warning of the escape and waste of their wares." This kindly attention on the part of our contemporary bears out what we have just remarked respecting the desire of the electric lighting interest to shuffle off all their proper share of responsibility for street explosions. It might be thought, by an impartial observer of these incidents of the development of the electric lighting industry, that those who provide the bombshell and fire the match are at least as much implicated in causing the natural result as those who unwillingly supply the charge. It is stated to be the practice of the Notting Hill Electric Lighting Company to send a man round to all the manholes in the higher parts of their district, where gas would naturally tend to accumulate, to lift the covers and to search for gas by smelling. Upon this it is reasonably remarked that it seems a pity to break the joints of the covers so often; and that the test is not so reliable as might be desired. A test-hole in the cover, secured by a lock-flap or a screw-plug, would be a useful improvement upon the ordinary tight street-box cover. Our contemporary suggests that an instrument might easily be constructed to measure the percentage of hydrogen present in the manhole. Upon this head it may be stated that our friends of the German gas industry have worked very enthusiastically upon this problem of the detection of gaseous mixtures in the subsoil of streets; but we really do not know of any appliance for ascertaining the presence of coal gas in culverts, &c., that can be conscientiously recommended as superior to the unvitiated olfactory sense of an inspector who is not engaged in gas-fitting; for the ordinary gas-fitter is not to be implicitly relied upon for smelling out gas. There is one electrician, at least, who does not mean to allow the question of the relative responsibility of gas and electricity for causing street explosions to arise in his district, if he can help it. This is Professor Robinson, of St. Pancras, who has adopted the American plan of blowing air into the parochial electric light conduits, with the view of expelling anything like a gaseous mixture.

HENRY F. WILLEY.

The sincere regret with which we record the death, last Tuesday evening, of Alderman H. F. Willey, ex-Mayor of Exeter, as the result of an illness which had lasted about three months, will, we are sure, be shared by a large number of our readers. Deceased was in every respect a self-made man; and his success in life must be attributed to the diligent exercise of the excellent business qualities with which he had been endowed. He commenced his career under Mr. Vickary, an ironfounder of Exeter, on whose death he practically conducted the business for the widow. Eventually, however, he severed his connection with it; and, in association with Mr. Ford, he started a gas engineering business. This undertaking soon grew to large dimensions, with the result that the name of Willey is known throughout the gas industry of the British Isles. Mr. Willey was personally known to a great many gas managers; and it may be remembered that, on the occasion of the visit of the South-West of England District Association of Gas Managers to Exmouth last September, he was present to give the members a kindly welcome to Devon. In his public capacity, Mr. Willey was valued for his sound, commonsense judgment; and he will be greatly missed. He first entered the City Council as a representative of Trinity Ward; but he lost his seat about ten years ago, and did not seek to regain it. He, however, was eventually elected Sheriff during his absence from the city. Soon after this he was elected an Alderman, and was appointed a Justice of the Peace; and in both positions the duties devolving upon him were most faithfully performed. Last year he became Chief Magistrate. At the last mayoral banquet, it was suggested that he should be made an honorary Freeman of the city; and the Council unanimously conferred that honour. The illness which has ended fatally may truly be attributed to Mr. Willey's devotion to his public duties. In the early part of last December, he took cold while on a visit, in very severe weather, to the Exeter water-works, in his capacity of Chairman of the Water Committee of the Council. The cold brought on an attack of asthma, to which he had been subject; and from this, in his weak condition, he never rallied. Mr. Willey was in his 64th year; and he leaves a widow, three daughters, and three sons (two being in the business), for whom the deepest sympathy is felt in their bereavement.

GAS APPARATUS AND THE MEDICAL PRESS.

The attention that is being given to gas apparatus and the uses of gas in the popular magazines and in technical periodicals not usually concerned with furthering the interests of the gas industry, is one of the most gratifying evidences of the growth, among the general public, of an intelligent appreciation of the part which gas plays, and has yet to play, among the other appurtenances of modern civilization. In particular, the discussion of consumers' gas appliances in the columns of the medical press is to be welcomed, seeing the enormous influence exercised by the members of the medical profession upon the choice of the community in such matters as the means of lighting, warming, and cooking available by dwellers in towns. We recently had occasion to mention and comment upon the manner in which gas-stoves were dealt with in the pages of the *Lancet;* and justice requires that equal prominence should be given in our columns to the action of the other principal organ of the medical profession—the *British Medical Journal*—which has just completed a series of illustrated articles on "Cooking and Heating by Gas" that have run through six numbers, commencing on Dec. 2 and ending in the issue for the 17th ult. What with the praiseworthy efforts of these two important periodicals, it must be allowed that the advantages of a wisely-extended use of gas in the household have been thoroughly well brought under the notice of that "guide, philosopher, and friend" of the British householder—the family doctor.

The articles in the *British Medical Journal* bear the impress of an expert. The first of the series explains the part which gas and gas-fires are ready to play, if the householder will let them, in warming a house in a cleanly, inoffensive, and efficient manner. The writer's candour is manifested at the commencement of his work, in the frank admission that "for sitting-rooms, in which fires are burning continuously for ten, twelve, or fourteen hours a day, gas is undoubtedly a dearer fuel than coal, and cannot be recommended on the score of economy (except in so far as servants' labour is saved)." He immediately proceeds to say, however, that "there can be no doubt whatever of the economy of gas-fires for bedrooms, drawing-rooms, &c., where an occasional fire is required. In such cases, a fire may be lighted and burnt for an hour at a cost of 1d. for gas, entailing no servant's labour, either in laying or in cleaning the following morning." The writer might well have driven his point farther home, having regard to the character of the publication in which the article appears. There is no permanent advantage to be gained by denying the fact that when a fire is

needed in an apartment for more than six hours continuously day by day, the mere fuel cost of gas is likely to be more than that of coal. Sixpence a day is not an unfair figure at which to take the average cost of a coal fire; and with gas costing 1d. an hour in a fire (which is also a reasonable figure), it is easy to see where the line of equal expense must be drawn. If all the apartments in British towns where a fire is only needed for six hours a day, or less, were to be fitted for warming by gas, what a splendid thing it would be for the gas industry and the gas-stove trade! Think of all the mercantile offices, lawyers' chambers, official rooms of all kinds which could actually be warmed by gas to advantage in every respect—cheapness, convenience, adjustability to a varying external temperature, and security from extinction without constant watching, which in itself is a severe tax upon a busy man. There is no need to push the use of gas-fires for domestic sitting-rooms in constant use, where it would be extravagant, while there is yet so much room for it in places where it is capable of saving the users' pockets and time.

Moreover, as we have said, having regard to the circumstance of the articles being designed to interest the members of the medical profession, the writer might have laid any amount of stress upon the superlative recommendations possessed by a gas-fire for a doctor's reception-room and for his private study. This fact has indeed been generally found out already; for in such apartments the gas-fire is very often seen, and is fully appreciated. By this means, the doctor is rendered independent of servants. The faithful gas-fire will always keep a pair of boots and slippers warm, for instant use at any hour of the night; and the study will always be a cheerful place for the greatly-harassed "general practitioner" to return to after a tedious round. The advantages of a gas-fire in a bedroom also shine conspicuously bright in cases of sickness. The kettle is always ready; the fire needs no making-up; and the moist warmth so necessary for the relief of many distressing symptoms is maintainable by this agency with the greatest ease.

We notice that the writer of the articles states that gas-stoves of the "condensing" type have come much into favour of late years. This statement might be questioned; inasmuch as the type has been upon the market for a considerable number of years, and has always enjoyed a certain degree of popularity. This, however, is usually transient in every individual case, in consequence of the tendency of the appliance to look shabby after even a brief use. If the statement were broadened to take in the whole order of gas warming-stoves having luminous flames, it would pass unchallenged; for there can be no denying that the once undisturbed monopoly of the atmospheric flame for heating purposes has been largely encroached upon during the past few years. The teachings of Frederick Siemens have been mainly instrumental in bringing about this result; for as soon as it is accepted as a fundamental principle in pyrology that a flame should never be allowed to impinge upon any solid substance, thereby putting itself out before it has time to finish its work, the logical sequence asserts itself in favour of the luminous flame. The writer of the articles observes that stoves with luminous flames should always have "flue attachments," which is doubtless correct as a "counsel of perfection." All apartments intended for human occupation, whether they are to be lit or warmed by gas or otherwise, ought to be provided with flue attachments; but, upon the question of practice, we have never been able to understand why sanitarians should make so much more fuss about the removal of the products of combustion from luminous flames situated at or near the floor-level (where there is usually enough draught to turn a mill), than they do about the ventilation of lighting burners of equal power discharging into the hermetically sealed upper region of a room.

It is with regret that we find the writer in the *British Medical Journal* repeating in one of his articles the absurd suggestion that the most wasteful gas-fires are "very popular with gas companies," who "push them energetically." He ought to know that it was the dread of having some such aspersion cast upon them which for a long time kept gas manufacturers from having anything to do with the sale or hiring-out of gas-stoves. It is in truth very wearisome to come across superstitions of this character embedded in present-day writings. This writer, referring to what he supposes to be the gas companies' weakness for extravagant gas-stoves, remarks that the consumer who may have been "induced to fit them up, and use them freely in his house, is apt to open his eyes when his next quarter's gas bill comes in." It never, of course, occurred to this critic that the consumer's next action, in such an eventuality, would be to turn out all his gas-fires, and that for the remainder of his natural life the same man would be the greatest enemy of the gas company, and would never hear anybody mention a gas-stove without most solemnly warning him against having anything to do with such delusions and snares. Does this writer ignore the sound commercial maxim that a contented customer is a perpetual advertisement?

But when he comes back to technics, the writer returns to reason. He points out that in all gas-stoves the gas consumed is the only possible source of heat—a tolerably patent fact which the writer on the same subject in the *Lancet* failed to realize; and that consequently gas burnt from ordinary illuminating burners will yield the maximum of heat-effect for the quantity of gas consumed. He spends a good many words over this part of his subject; yet he fails, for some reason, to treat it with due regard to principle. It is a fact that the lighting burners do a good deal towards warming a room; and very glad most of us are to take advantage of this quality "when winds whistle cold" in winter, and the blazing open coal fire is found to be chiefly efficacious in creating powerful draughts. For heating purposes, however, the usual lighting burners are placed too high. We want warmth on the floor-level. It seems curious also that the writer of these articles does not perceive that the luminous gas-flame is a radiator of heat; and also that the more luminous it is, the hotter it is. This is the converse of the theory of the recuperative burner, which is in reality as efficient a stove as it is a lamp. Instead of leading his readers on to look at the problem of gas warming in this way, he drags back their attention to such old-fashioned appliances as George's "Calorigen" and Dr. Bond's "Euthermic" stove, neither of which has proved capable of holding the market as an article of trade, or as a conspicuous example, from the scientific standpoint, of how to burn gas so as to get the utmost heat from it.

Coming to the discussion of gas cooking, the writer ventures upon the assertion that "public education in this direction had its origin in the first electric light scare, when gas companies and corporations—alarmed at the advent of a rival lighting agent—at once set about the education of their consumers with reference to the merits and advantages of gaseous fuel." It is admittedly difficult in writing history to distinguish fortuitous sequences of events from connected causes and effects. In this case there was merely a coincidence of time between the advent of commercial electric lighting and the popularization of gas cooking, which was brought into prominence more by the smoke abatement movement than by any other contemporaneous proceedings. The writer trots out once more the ingenuous argument about the yield of cooked meat being greater from a gas-oven than from a coal-oven by something like 15 per cent. We have seen in trade circulars this difference priced out in terms of the value of the cooked food; but the very smallest reflection must convince anyone to whom the argument is addressed that the difference in question, if it exists in all cases, can only be due to the presence in the joint of a greater or smaller proportion of water. We should be sorry for the patients in hospitals and for the inmates of other large institutions where such a source of economy might be relied upon in the every-day victualling arrangements. We observe that the writer makes a praiseworthy attempt to grapple with the hot-water difficulty, which always crops up whenever a proposal is made to dispense with coal fires in the kitchen. He says: "All that is necessary is to place by the side of the gas-oven a small gas-boiler constructed to stand ordinary pressure. This boiler is attached to the circulating tank or cistern by the ordinary flow and return pipes, and simply supersedes the pressure-boiler usually placed behind the range fire. This gas-heated boiler will do the work effectively of heating a 30 or 40 gallon tank for baths, &c., at a cost not exceeding 4d. a day." There is too much of the mere *obiter dictum* about this assertion to carry much weight; and one would prefer to have an example cited, to show that such an arrangement had been tried somewhere and found to work satisfactorily. For ourselves, as having watched many more ambitious attempts to solve the hot-water problem by gas, we do not believe in the possibility of doing anything like so much as the writer claims, for so little. It is no easy matter to keep up a supply of hot water by means of gas burning at a possible rate. On the whole, however, the articles are likely to be of service for the purpose intended by the writer; and the *British Medical Journal* is certainly deserving of thanks for having published them.

THE PRINCIPLES OF WATER-WORKS ENGINEERING.*

The principles of water-works engineering are many and varied; and there is no branch of the practical "application of the phenomena and forces of Nature to the uses and purposes of man" in which a more discriminating judgment is required. Again, although only a small portion of the water actually used in any large city is drunk, the potability of water is the test required when statutory powers are granted to water companies; and the practice of the engineer has to be guided, to a great degree, by the analyses of the chemist, the microscopist, and the bacteriologist. Our authors follow the natural and logical sequence of inquiry by considering, in the first place, how water is derived, how its quality is likely to be impaired, and whence it should be obtained so that its purity may be best guaranteed.

Another question, however, that lies in the forefront of the inquiry is the quantity of the supply that is available for use in a given locality. Such subjects as prevailing winds, the lie of the land, the contour of the ground, and its suitability for enclosure, have to be considered after the engineer has satisfied himself, by critical examination, as to the purity of the source. And then, the maximum quantity available being calculated by means of gaugings of the supply from a given catchment basin, it is further important to know how the supply varies by the day,

* "The Principles of Water-Works Engineering." By J. H. Tudsbery Turner, B.Sc., M.Inst.C.E., and A. W. Brightmore, M.Sc., Assoc.M.Inst.C.E. London: E. and F. N. Spon; 1893.

month, or year, which can only be discovered by means of rain-gauges distributed over it. By this means also are inferentially obtained the losses by evaporation, percolation, and absorption. In this connection, certain laws of hydrodynamics and hydraulics have to be studied, having special relation to the flow of water in open channels, in closed conduits, and in pipes, as regards quantity and velocity; and, to aid him in his researches, such mechanical appliances as gauges and meters come to the engineer's assistance.

In some instances, available sources of supply are ready to our hands; and we have only to be careful in collecting the water and in making arrangements for supplying it at higher elevations. There are some cases in which we can rely alone upon gravitation; but in the majority of instances pumps and other water-raising machines have to be used, and their construction and efficiency studied, whether in connection with the supplies from rivers or from springs and wells, where at the outset boring and well-sinking operations have to be undertaken. Where these sources are not available, water has to be stored; and the engineer, having already selected his site, has to consider what capacity he ought to give his reservoirs. He has to take into account what kind of embankment he should use—whether of earth with puddle walls, or of solid masonry—and the best design of dam, so as to combine absolute stability with lightness and economy of construction. Then, a reservoir having been built for a required specified supply, an important appendage in connection with it is the waste weir for carrying away flood waters, and the culvert which during construction conveys the water to its natural channel, and afterwards takes the pipes through which it is carried to its destination.

We have already adverted to the importance of a pure source of supply. But in a very large number of cases water has to be filtered before it can be conveyed to the place where it has to be consumed; and questions as to the size, number, and kind of filter-beds have to be considered. These are affected in their turn by the thickness of the filtering medium, the size of the grains of which the filter is made, and the quantity and pressure of the water supplied. Sand is the material generally employed; but iron oxide and spongy iron are also used for this purpose.

Where the water supply is not conveyed by rivers, artificial conduits have to be made. Aqueducts are the very earliest forms of engineering construction; the supply of water being one of the first problems that had to be grappled with. The conduits have to be water-tight, and are either open or closed channels. The great object is to deliver the quantity of water required with the least friction; in other words, to obtain the largest area of section with the least perimeter or surface. The geometrical figure which possesses this property is the circle; and hence circles, or combinations or sections of circles, to meet special requirements, are the figures employed. The sizes and gradients of conduits to deliver a given quantity at a desired speed, and the thickness of the bounding periphery of conduits, whether of masonry or of metal, and the material employed, are problems dependent upon the individual circumstances of the case; while the laying and jointing of pipes require careful attention and experienced practice.

In the consideration of the distribution of water, statistical data have to be obtained; and works have to be constructed and appliances arranged so as duly to appropriate the supply, as regards rate and pressure of delivery, to the varying requirements of consumers. Among other things calling for consideration are the position and size of service reservoirs, the arrangement of reducing valves, the direction and size of mains, and the position of branch distributing pipes, so that the supply to houses from the service-pipes may be delivered with the least possible friction, and from hydrants, in case of fire, at full pressure and in large volume right above the highest houses in the district.

Finally, the regulations have to be considered which are best suited to the convenience of the general public requiring the water, and which will at the same time preserve the distributing company from the loss due to deliberate or careless waste. The general principle which guides such regulations is to have, at the time it is needed, water in adequate quantity and at a sufficiently high pressure, on the one hand, and, on the other, to have the fittings of such a character that none of the water shall run to waste, and that what is required for flushing shall be delivered in requisite quantity at the quickest rate.

Our authors give to their book the title "The Principles of Water-Works Engineering;" and although they sometimes go into details which can hardly be said to come under the head of "principles," the general intention of the work has been well carried out in its production—all the subjects above referred to having been well and clearly treated. The authors' object has been to provide a book which shall be of use to those engaged in the design of water-works; to those who desire a general, but accurate, knowledge of a most interesting subject from a sanitary point of view; and, lastly, to students of this branch of engineering. The first two classes of readers will, we think, find the work useful and interesting; but whilst it is hardly likely, as it is probably not intended, to form a manual or text-book to the third class, who are entering upon the subject for the first time, it will be just the book to place in the hands of one who, having passed through his college *curriculum*, is first engaged on practical work.

NOTES.

Matton's Gasholder-Cup Overflow.

In a "Note" which appeared in our issue for Jan. 16, mention was made of an American patent of Mr. F. V. Matton for an overflow device for telescopic gasholders. Owing to the imperfect manner in which the "Official Gazette" of the United States Patent Office is compiled—only the claims being given, with a selection from the patentee's drawings, but no explanation of the object of the invention—we misrepresented Mr. Matton's design. This unintentional misstatement we are now able to correct, and do full justice to what is in reality a very meritorious invention. It consists of an internal overflow for gasholder cups, intended for application to holders exposed to severe cold. In such cases, it is customary in America, as also to a limited extent in England, to prevent the water in the cups from freezing by supplying steam to them. The steam in condensing naturally increases the volume of water in the cups, until in some cases it flows over the top of the grip and runs down outside the holder. In so doing, the water will in severe weather form ice on the holder sheets, occasionally accumulating in such thickness and hardness that the holder in descending is liable to be injured if the ice is not removed in time by the attendant. It is often difficult to clear away such accumulations of hard ice without injuring the light sheeting of the holder. To obviate the necessity for watching holders during the cold and dark winter nights, Mr. Matton has devised his "internal overflow," which has the effect of carrying all the surplus water from the cups to the inside of the holder instead of to the outside. In this way the formation of ice on the outside of holders can be prevented, and the risk of damage from this cause entirely removed. The device is extremely simple; consisting only of a syphon-pipe in the cup, having its long leg carried up to within an inch or two of the top of the cup, and its short leg penetrating by means of a bend through the side of the inner lift at a suitable level.

The New Street Lanterns in the City of London.

The problem of lamp posts and lanterns has been settled by General Webber, in connection with the development of the the street lighting plans of the City of London Electric Lighting Company, upon novel lines which were explained by the author in a paper recently read before the Institution of Electrical Engineers. The lamp-posts are of noble proportions; the lantern being big enough for a man to get inside. To give access to the latter, the posts have holes alternately on either side, into which the lamp-trimmer puts eight portable foot-rests of light steel, by means of which he mounts, and which he removes as he descends. Experiments with different kinds of lantern glass led to the adoption of a rippled plate, which is not only cheaper than ground and opal glass, but is more translucent. It was found when clean to stop only 21·73 per cent. of the light of the arc lamps, as against 25·18 per cent. and 46·24 per cent. for the ground and opal glass. The glass in actual use is one-seventh of an inch thick, and is therefore not liable to easy breakage. When the Company come to use large incandescent lamps for some out-door situations, as they hope to be allowed to do in time, General Webber thinks of proposing that these shall be shielded by facetted glass, which, while breaking up the direct rays of light, would not obstruct so much of it as either ground or opal glass. In all these suggestions, the effect of dirt seems to be ignored, although it asserts itself obviously enough in practical working.

The Innocuousness of Sewer Air.

Mr. J. Parry Laws has made a remarkable report to the London County Council, upon certain investigations carried out by him, according to instructions, on sewer air. It is observed that, although sewer air has for a long time been regarded as dangerous, and a likely source of infection in certain specific diseases, very little has been done to substantiate this hypothesis by scientific research. Mr. Laws quotes a report of Dr. Letheby in 1857-58, to the Commissioners of Sewers of the City of London; but this was long before the days of bacteriology. The most important and most recent investigation on the subject is that of Drs. Carnelly and Haldane, who made a series of observations in the main sewer in Westminster, and in various sewers in Dundee. The general conclusions of these investigators go to show that the air of sewers is much better than might have been expected. Mr. Laws chose for his first operations a sewer constructed 120 years ago, running from Piccadilly to the Buckingham Palace Road, and selected because the conditions in it are simple and uniform, and of long-standing. The experiments embraced tests of the normal sewer air, splashing experiments, and deodorizing experiments; and they were conducted according to methods described in detail in the report. As a result of his labours, Mr. Laws arrived at the conclusion that the micro-organisms in the sewer air were related to the micro-organisms in the air outside, and not to the micro-organisms of the sewage. In the air both within and without the sewer, the forms of micro-organisms present were almost exclusively moulds and micrococci; on the contrary, the micro-organisms of sewage are for the most part bacilli. For purposes of deodorizing, manganate of soda and sulphuric acid, and carbolic acid, were the most

efficient of the several chemicals tried. The whole of the results recorded go to show that the principal, if not the only source of micro-organisms in sewer air, is the air without the sewer, and not the sewage; and they also tend to prove that there is very little ground for supposing that the micro-organisms of sewage, in the absence of violent splashing, become disseminated in the sewer air. Mr. Laws prudently emphasizes the fact that these observations only hold good for sewers in which the conditions are the same as those under which he experimented. What the condition of the air would be in sewers in which there is only an intermittent flow of sewage, or in which the sewage becomes stagnant and highly putrefactive, further experiment was needed to show. Yet it may be remarked that Mr. Laws speaks of the smell of this innocuous sewer air as being "indescribable, yet intensely disagreeable." In an addition to his first report, Mr. Laws deals with some of the questions left open by his earlier experiments, and confirms his general conclusions. His final observation on the subject is as follows: "Although one is led almost irresistibly to the conclusion that the organisms found in sewer air probably do not constitute any source of danger, it is impossible to ignore the evidence, though it be only circumstantial, that sewer air in some instances has had some causal relation to zymotic disease. It is quite conceivable, though at present no evidence is forthcoming, that the danger of sewer air causing disease is an indirect one; it may contain some highly poisonous chemical substance, possibly of an alkaloidal nature, which, though present in but minute quantities, may, nevertheless, produce in conjunction with the large excess of carbonic acid a profound effect upon the general vitality." If this passage means anything, it means that Mr. Laws is almost afraid to trust his own results, in so far as these may be interpreted as discounting the importance of sewer ventilation.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Annual Meeting in Manchester.

The Twenty-fourth Annual Meeting of this Institution was held on Saturday last at the Palatine Hotel, Manchester. The PRESIDENT (Mr. W. R. Chester, of Nottingham) occupied the chair at the outset, and briefly welcomed the members, of whom there was a large attendance.

The HON. SECRETARY (Mr. S. S. Mellor, of Northwich) read the minutes of the last meeting, which was held at the above-named hotel on Nov. 25, and these were confirmed.

NEW MEMBERS.

Mr. S. R. Ogden, Engineer and Manager of the Blackburn Corporation Gas-Works, and Mr. J. Chadwick Smith, Manager of the Denton Local Board Gas-Works, were unanimously elected members of the Institution.

THE ANNUAL REPORT.

The HON. SECRETARY read the annual report of the Committee, which was as follows:—

In presenting their annual report, your Committee desire to congratulate the members on the continued prosperity and success of the Institution. During the past year, five new members have been elected; two have resigned; two cease membership under rule 17; and one very highly-esteemed member (Mr. Jas. Paterson, of Warrington), a founder of this Institution, has been withdrawn by death. This leaves the Institution with a roll of 90 members at the end of the year.

The annual meeting was held at the Palatine Hotel, Manchester, on Saturday, March 2, which was very well attended. After the election of new members and officers for the year, Mr. W. R. Chester, of Nottingham, was installed in the presidential chair by Mr. W. W. Hutchinson, of Barnsley, who took the chair in the unavoidable absence of Mr. T. O. Paterson, the retiring President. Mr. Chester delivered an interesting address—reviewing the position of the gas industry at the present date, and tracing back the steps of progress which had been made year by year since its inauguration at the commencement of the century. The address was illustrated by a diagram showing the relative prices of coal, labour, and gas during that period. At the conclusion, the President was accorded a hearty vote of thanks.

The second meeting of the year (which is usually held at the end of May) was held a few weeks earlier, so as not to clash with the Whitsuntide Holidays. The meeting took place on Saturday, May 5, when the members gathered at Northwich, with the object of inspecting the Weaver Navigation and that portion of the Ship Canal between Saltport and Eastham. After the formal business had been transacted, the members in considerable numbers embarked on a steamer specially chartered for the purpose, and proceeded to Eastham, where tea had been provided at the Ferry Hotel. The weather was exceptionally fine, and the members had a most interesting and enjoyable trip.

In accordance with the general wishes of the members of the Institution, the Secretary, accompanied by Messrs. Armitage and Duff, went over to Belfast, to make arrangements for the accommodation of the members intending to be present at the meeting of The Gas Institute in June. The result of this visit was most satisfactory; and every member who went to Belfast had good reason to be grateful for the admirable arrangements these gentlemen made.

On the invitation of the President, the third meeting of the year was held in Nottingham on Saturday, Sept. 2. On account of the distance from Manchester, and the number of objects of interest the visit afforded, it was arranged that the members should depart from the usual custom of the Institution, and, proceed to Nottingham the day before, so as to be ready to commence proceedings at an early hour on Saturday. The members were met at Nottingham station by the President; and, after tea, they proceeded to visit the ancient Castle of Nottingham, which is now converted into an Art Gallery and Museum. They afterwards paid a visit of inspection to the Natural History Museum at University College, to inspect an extensive installation of lighting and ventilation by gas, which had recently been carried out by the President. On Saturday, Sept. 2, the members assembled in the Market Place at 9.30 a.m., and, under the guidance of the Borough Engineer, Mr. Arthur Brown, M.Inst.C.E., proceeded to inspect the subway for gas and water pipes, sewers, and electric wires, which had recently been carried out under his supervision. They then visited the Eastcroft Gas-Works, and were much interested in the extensive additions and alterations which were being carried out by the President on these works; the members then proceeded by coach to the Basford Gas-Works, passing the ancient Castle Rock *en route;* and after thoroughly inspecting these interesting works, and paying particular attention to a system of coke breaking, sorting, and washing machinery in operation, were photographed. They were then entertained to luncheon by the Gas Committee; the Vice-Chairman of the Gas Committee, the Sheriff of Nottingham, and the Town Clerk (Sir Samuel Johnson) being present to welcome the members and do honour to their President. After luncheon, formal business was transacted; and a hearty vote of thanks was accorded to the Gas Committee for their hospitality. The members then proceeded by coach to the Giltbrook Chemical Works, a distance of eight miles, when the President and his assistants pointed out the various apparatus for the manufacture of sulphuric acid, tar, sulphate of ammonia, and artificial oxide of iron then in operation. On returning to Nottingham, tea was served at the George Hotel; and the members, after a most instructive and enjoyable meeting, returned to Manchester by the 7.10 p.m. train.

The last meeting of the year was held at the Palatine Hotel, Manchester, which was presided over by the Senior Vice-President (Mr. James Braddock, of Radcliffe), in the unavoidable absence of the President through illness. There was a good attendance of members. Mr. Braddock was unanimously elected President for the ensuing year. Mr. John Chadwick, of Oldham, then read a very interesting paper, on the "Stacking of Coal, and Coal Haulage Machinery," which elicited a good discussion.

The members retiring from the Committee are Mr. W. S. Haddock, of Warrington, and Mr. W. Duff, of Morecambe.

W. R. CHESTER, President.
March 3, 1894. SAMUEL S. MELLOR, Secretary.

Mr. W. SMITH (Hyde) moved the adoption of the report, and the accompanying statement of accounts; and, as one of the Auditors, he testified that the accounts were kept in an admirable manner.

Mr. A. SHIRES (Biddulph) seconded the resolution, which was carried.

ELECTION OF VICE-PRESIDENTS AND TREASURER.

The PRESIDENT, remarking that they had now to elect the officers for the ensuing year, pointed out that the nominations had received the very careful consideration of the Committee; but the Committee did not wish to impose any names upon the members present. It was most desirable that those who were elected should receive the unanimous vote of the members, and should be representative of the members. Mr. G. Smedley, of Buxton, who was last year the Junior Vice-President, in the ordinary course of events would proceed a step higher, to the senior vice-presidentship.

Mr. J. CHADWICK (Oldham) proposed the election of Mr. Smedley as Senior Vice-President for the ensuing year. For many years Mr. Smedley had, he said, been a member of the Institution; and for a considerably longer period he had been connected with the gas profession. He had taken an active interest in the working of the Institution; and if they elected him to the office now suggested, he would personally appreciate it, and would fill the office to their entire satisfaction.

Mr. R. MERRELL (Mossley) seconded the resolution.

The PRESIDENT, in putting the motion, said Mr. Smedley was a very old member of the Institution. He was held in very high esteem by those who knew him; and he would, no doubt, when the time came, make a very admirable President.

The motion was adopted.

The PRESIDENT remarked that they had now to elect a Junior Vice-President; and it afforded him very great pleasure to nominate to that office a gentleman who would, he thought, meet with their very cordial approval. There was probably no member of the Institution who had done better work for it than Mr. Isaac Carr, of Widnes; and there was none who had met with a greater amount of undeserved obloquy. Mr. Carr would go forward to the presidency, and would no doubt do honour to the Institution both as Vice-President and President.

Mr. J. TIMMINS (Wigan) seconded the resolution. He felt that it would be a very wise thing to select Mr. Carr for this office; for his experience had been of a varied nature, and he would bring this experience to bear on the conduct of the office.

The resolution was carried.

Mr. J. HEPWORTH (Carlisle) proposed the re-election of Mr. T. Newbigging, of Manchester, as Treasurer. He remarked that this gentleman had not only the qualification of probity, but he had this additional qualification that he was a Scotsman, and knew how to take care of the "siller."

Mr. HARRISON VEEVERS (Dukinfield) seconded the resolution, which was adopted unanimously.

Mr. NEWBIGGING, in acknowledging this vote of confidence, said the duties were not by any means onerous, but they were honourable; and it was a source of very great gratification to

him to think that he should have gained, and for so many years have retained, the confidence of the members of the Institution.

ELECTION OF SECRETARY.

The PRESIDENT said the agreeable duty was imposed upon him of proposing the re-election of Mr. Mellor as Hon. Secretary for another year. Mr. Mellor was an ideal Secretary—energetic, with his heart thoroughly in his work, and carrying out that work in a manner which must be satisfactory to everyone who came in contact with him, either as a member of the Committee or as President of the Institution. During the past year, the Secretary's work had been arduous. But it had been carried out in a most admirable manner; and he (Mr. Chester) hoped the time was far distant when they would have to say good-bye to Mr. Mellor as Secretary of the Institution.

Mr. BRADDOCK, in seconding the resolution, said that, as one who was to take an active part in the business of the Institution during the coming year, he counted himself fortunate in that the services of Mr. Mellor as Secretary were to be retained for another year.

The resolution was carried by acclamation.

Mr. MELLOR thanked the members for the compliment paid him in his re-election to office. He began to think it was quite time he gave up the position in favour of someone else; but as they had thought fit to elect him, he would try to serve the Institution to the best of his ability during the coming year.

APPOINTMENT OF OTHER OFFICERS.

On the motion of Mr. BRADDOCK, seconded by Mr. J. L. MITTON (Longwood), Mr. W. H. S. Gendall, of Bury, was elected a member of the Committee for the ensuing three years. Mr. Robert Porter, of Elland, was also appointed to serve on the Committee for a similar period, on the motion of Mr. MELLOR, seconded by Mr. J. WILKINSON (Pudsey).

Mr. ISAAC CARR proposed the re-election of Mr. W. Smith, of Hyde, and Mr. J. Mackenzie, of Wilmslow, as Auditors. In doing so, he referred to the satisfactory state of the accounts, and remarked that the thanks of the members were certainly due to Messrs. Smith and Mackenzie for the services they had rendered in the past.

Mr. J. E. LAMB (Altrincham) seconded the motion.

The PRESIDENT, in putting it to the vote, said he hoped the two gentlemen who had done this useful service to the Institution would take it as a mark of confidence that they were asked to continue to act.

The resolution was adopted, and

Mr. SMITH acknowledged it; remarking that the Auditors' duties were very light, for the accounts were kept in admirable order by Mr. Mellor.

INSTALLATION OF THE NEW PRESIDENT.

The PRESIDENT: I now come to the most important portion of our proceedings to-day; and I do it with a great amount of satisfaction, and with a sense of personal relief from the responsibilities which our friend Mr. Braddock is about to accept. I do not propose to occupy your time, or in any way to stand between the new President and his address and yourself. I will merely content myself by introducing the President for the ensuing year, Mr. James Braddock, of Radcliffe—a gentleman who was one of the founders of the Institution, who has belonged to it from its earliest infancy, who has taken the utmost interest in its proceedings, and who of all the members I have known has attended the most meetings in connection with the Institution. I am sure his election has your entire approval; and I have now very great pleasure in calling upon him to relieve me of the chair, and to take his position as President of the Manchester District Institution.

PRESIDENTIAL ADDRESS.

Mr. BRADDOCK then took the chair vacated by Mr. Chester, and delivered the following

INAUGURAL ADDRESS.

Gentlemen,—The call to occupy the position of President of this Institution, for the twenty-fifth year of its existence, is one well calculated to fill the recipient of it with a degree of pardonable pride. As honour has been conferred on me by the selection you have made, it is fitting that you, in return, should have the assurance that your favour is highly esteemed and gratefully accepted. But a position of this character has also its obligations, one of the foremost of which is that, on taking the chair, your President shall address you on such topics as seem to him suitable for the occasion.

First, then, I would say a word of congratulation on the continued prosperity of the Institution. Not that there is any great accession of numbers. That, from the nature of things in connection with this District Association, cannot be expected, as we already enrol the bulk of the engineers, managers, and secretaries of Lancashire and Yorkshire, with a fair sprinkling from the adjoining counties; and as each member is, as a rule, the sole representative of the town in which he is engaged, it is clear that only by an increased number of towns could we hope to obtain much increase in membership.

This isolation, to which I have just alluded, brings about that craving for fellowship so highly appreciated at our quarterly meetings, when to the listening ear of congenial spirits we can "fight our battles o'er again," assured that an appreciative, if critical audience welcomes their recital. Again, who is there amongst us who has not at one time or another come to our meetings with some problem utterly beyond his powers of solution? By talking it over with others, light has gradually dawned upon the subject, and that which seemed beset with difficulties has become simplicity itself.

That which is uppermost in mind, as recent experience, is the vast disorganization of gas manufacturing affairs in common with many other industries consequent on the suspension of work by the 300,000 miners of Lancashire, Yorkshire, and the Midlands, for a period of sixteen weeks during the late autumn. That it should be in the power of any body of men to so effectually close the mines as to send up to famine prices so essential an article of daily life as coal—bringing in its train ruin to tradespeople, misery, and destitution—is a serious factor of national importance. Perhaps the two redeeming features of the case are the heroic fortitude displayed by the men and their families in their poverty, and the fact that (as in the great cotton strike of the previous winter) the issue was referred to a Board of Conciliation of employers and employed.

To us, as coal gas makers, the matter now presents itself in the form of the question, How are we to provide against a repetition of the consequences of such an occurrence? Clearly, by holding as large stocks of coal as is practicable; as it was recently seen that those who could continue their gas supply without purchasing coal had the least disorganization of business. And, secondly, by the adoption of processes for gas making into which coal does not enter.

On the question of stocking coal, I hold the opinion that it is better to put to stock a given quantity of coal, to remain undisturbed until an emergency arises, rather than to work the whole out year by year. In the former case, there will come in operation a decremental rate of loss, being less in the aggregate over a series of years than the sum of the losses taking place from an equal quantity of fresh-wrought coal.

In the selection of suitable coal and cannel from the various lots—good, bad, and indifferent—which are annually offered in response to the invitations to tender, the conscientious gas manager has scope for the exercise of his best judgment. The problem does not resolve itself simply into a question of the price, make of gas per ton, and illuminating power. There are other considerations which must enter into the calculation, if the best offers are to be selected. These are charges for depositing the material on the works (if any), stacking, stokers' wages, fuel used in carbonizing, interest, wear and tear of retorts, &c.; credit being given, on the other hand, for the quantity and value of the residual products.

But with all one's efforts in the selection of materials, the results are liable to frustration by the supply in bulk being inferior to the sample upon which the purchase is made. Here comes in the utility of the experimental plant with which all well-regulated works of large size are equipped. But it is well to discontinue dealing at the first opportunity with any unscrupulous contractor.

A hindrance to the more general adoption of the truly scientific system of regenerative firing for retort-settings is the existence of so many ground-floor retort-houses. We were shown at Nottingham, during our recent visit, a fine example of how these may be converted into stage-floor houses, and so this objection overcome.

The introduction of machinery for crushing, conveying, and elevating coal, and for the drawing and charging of retorts is beyond the stage of experiment. It is indeed essential to the highest success of a gas-works of even moderate size. Machinery not only gives that flexibility of production which is unattainable by hand labour, but there is a distinct monetary advantage accruing from its use.

In no branch of our business is there greater activity or thought than in the various processes which are being devised to supplement the production of gas made from coal with that of gas from other substances, and to supersede the enrichment of gas by other means than that of cannel. Among the enrichment and production processes may be named the Dinsmore, the Maxim-Clark, the oxy-oil, the Peebles, and carburetted water gas; the latter being a valuable auxiliary to certain gas-works by reason of the rapidity with which it can be brought into operation, by the utilization of coke, by the use of oil to the exclusion of either coal or cannel, and by its compactness and lessened cost. It is to be hoped that the success which has so far rewarded the effort to reduce the percentage of carbonic oxide will be retained when the production of the gas is made upon a more extended scale. The literature upon the subject of the manufacture of gas from other substances than coal is already considerable, and is being added to frequently. I confess that to me it is as entrancing as a novel.

The inclined retort system has been adopted by many who are well qualified to form an opinion of its relative merits. We now find that authorities who have made tentative trial of the system have subsequently put up larger installations. It is true it has its difficulties—these are inseparable from every new system; but they are gradually giving way to accumulated experience.

We have in these new methods of production, and in machinery as applied to the various processes of the retort-house, that which will form a salutary check on the growing tendency of the labour element in the carbonizing department to become somewhat unreasonable in their demands as well as

dictatorial in their attitude to their employers. In saying this, however, I would not be thought to place all men in this category. There are men who give a full return for their wages—men who make themselves indispensable to their employers; and, on the other hand, there are those who, unless compelled by the exigency of piece-work or incessant supervision, simply "mark time" from one pay-day to another. If Mr. George Livesey has succeeded in his bold attempt to reconcile these conflicting elements for mutual good, the sooner it is more generally known and acted upon the better for all concerned.

As in too many instances the products of combustion commingle with the air of the room in which gas is burnt, it is desirable to eliminate all impurities from the gas that are removable by the process of purification. The dry centre-valve will occasionally—whether it be from faulty construction, from deposits on the surface, from variations of temperature, or at the times of changing the direction of the flow of gas—permit the passage of unpurified gas. Hence the utility of catch purifiers so as to arrest such impurity as may casually pass the ordinary purifying apparatus.

During the past winter, I have had practical experience of the working of an automatic pressure changer as applied to the ordinary 18-inch governor; and the results are most encouraging. As the increase of pressure in mains which is applied at sunset is required chiefly to overcome the friction due to the flow of gas to the remote parts of the district, so that the pressure thereat may be maintained, it will be seen that there is a relation between the quantity transmitted through the main and the lowering of the governor or the vertical movement of the valve through which the gas passes. Advantage is taken of this descent of the governor to automatically take on water for the purpose of giving the additional pressure desired. When a diminished demand for gas subsequently ensues, the operation is reversed, and, with a lesser opening of the valve, a smaller pressure is substituted. Means are adopted to retain any minimum pressure, and to limit the maximum pressure as may be desired; also to neutralize the effect which a change of inlet pressure, caused by the cupping or uncupping of the gas-holders, has on the vertical opening of the governor valve. While on the governor question, I should like to add that, when the supply to a town is dependent on the issue from one gas-holder at a time, it is a prudent thing to insert a safety governor between the inlet and outlet mains of the holders, so that in the event of the holder outlet being closed by inadvertence, the supply to the town may be continued (if only partially) until the error can be remedied.

In the distributory department of a gas-works, the exercise of care and attention is well repaid. A weak spot is often found at the insertion of a service-pipe into a small main. This may not, however, reveal itself until the first severe frost, when the main may be found split at the point indicated. Self-acting syphons, from their liability to get dry, and so permit leakage into the drains and sewers with which they are connected, are a source of loss and danger. There is also the liability to reverse from a stoppage or flooding of the drain. I have found them a delusion and a snare; and I invariably order their abandonment. As a plan of the district of supply is a necessity for good management, and the making of a survey a most costly undertaking, it is perhaps well to remind some here that the sheets of the new Ordnance Survey, now in course of publication, are most helpful to a gas manager. The more useful ones are the parish maps on the scale of 1-2500th—being 25·344 inches to a mile—and the town maps, principally on the scale of 1-500th, or 10·56 feet to a mile. The parish maps will admit of a gas company's mains being shown thereon; while the town maps are on so large a scale as to allow not only mains to be shown, but services also, if that be thought desirable.

The item of leakage, or more accurately unaccounted-for gas, is made up from so many sources that it is impossible to say what influence each one has on the aggregate loss. It is affected by temperature, atmospheric pressure, leakage from gasholders, mains, services, and lamp-taps, loss in laying mains and services, inaccurate or stopped meters, and over-consumption by public lamps. Cases such as have recently occurred, of gas being used for years without the knowledge of the supplying authority, and an equally remarkable case well known to me of one authority supplying the gas, and the other, who had also mains in the district, receiving the payment, are, of course, exceptional. I said just now that it is not possible to apportion the loss to each cause; but, in the matter of mains and services, I am satisfied that in my case it is not an increasing quantity. Some years ago we fixed a 400-light meter; the inlet and outlet being connected to the gasholder inlet and outlet mains respectively. By closing all gasholder outlet-valves, the only supply to the town is through the meter; and it is only during the hours of minimum supply that this is practicable. Selecting a fine warm afternoon in the midst of summer, when there is no business, we ascertain by means of the meter the quantity of gas per hour passing into the mains, and infer (rightly, I believe) that the bulk of it must be leakage. From observations made over a series of years, we find that the quantity sent out at such times tends to diminish, until it has now arrived at 1255 feet per hour on upwards of 40 miles of mains and a proportionate length of service-pipes. Some may think the diminishing quantity indicates a lessened day consumption; but, from the precaution taken to select a suitable time for observation, and from the known tendency there is to an increased day demand, we are of opinion that it is rightly attributable to a smaller loss from leakage. This assumption is confirmed, to some extent, by the fact that the total quantity of gas unaccounted for is diminishing, though the bulk sent out is greater, and the mileage of mains and services naturally increasing, year by year.

In the matter of service-pipes, it is generally recognized that the method of laying them in a trough of wood, and covering the pipes with pitch, is an improvement on the older plan of laying the bare pipe in the ground. But I saw reason to discard all troughing, not only because of the wood decaying and holding moisture, but on account of the difficulty of ensuring the under side of the pipe being thoroughly coated with the pitch. The plan I have for many years adopted is, before laying each length of pipe, to have it covered with a hot solution of liquid pitch mixed with just sufficient creosote oil to convert it from a brittle substance into exceedingly tough and tenacious covering for the pipe, impervious to wet, and consequently well adapted to shield the pipe from corrosive influences.

As to the desirability of having consumers' meters in good working order and of adequate size, there will not be two opinions. When meters are the property of the tenant or the landlord, there is at times a difficulty in obtaining all that is necessary, as the tenant, though he may add to the number of lights, thinks the meter is equal to all demands made on it, and that a larger one means a higher bill, irrespective of the quantity of gas consumed; while the landlord, if he be appealed to for an order, argues that what has served hitherto ought to continue. The adoption of the hired-meter system certainly facilitates the introduction of good meters, and the means of making such changes as may from time to time become necessary. Nine years ago, the Company with which I am identified had issued on hire about 8 per cent. of the meters then working. A reduction in the rate for hire, with free fixing, was then introduced; and the effect has been that now the number on hire has increased fourfold, so that, on a greater list of consumers, 25 per cent. of the meters are hired. As I look on any charge for meter-hire as a hindrance to the more general adoption of gas, I view with favour the reduction of those charges as instrumental in throwing under the control of the gas supplier increasing numbers of meters, and thus leading up to the eventual abolition of the system of charging meter-rents. I am well aware of, and have respect for, the arguments of those who contend that these rents should, in equity, be retained; but I think the reasons they give are more than counterbalanced by what is expedient.

Turning now for a moment to the consideration of the production and disposal of our chief residual, coke, the measure of success in production is, of course, the highest percentage of the quantity made which can be sent out of the retort-house for sale. In this respect the use of some form of regenerative setting, by diminishing the quantity required for carbonization, increases that available for sale by about 2 cwt. per ton of coal carbonized, or 25 per cent.

Coke appears to have a commercial value above what may be termed its thermal or heat-giving power, when compared with coal. This probably arises from it being a smokeless fuel, and thus indispensable for some processes irrespective of its price. When broken, it is well adapted for the various slow-combustion stoves. One of these, if placed in the hall or basement of a house, and charged (say) once in twelve hours, will do much to give that degree of warmth to the passages and upper rooms which in winter is in many cases lacking.

For the effective sale of coke, large storeage is necessary, so that that which is produced in winter in excess of the demand, may be held until the summer sales, which are in excess of the production, bring about its absorption. In this way, and by varying the prices so as to about clear the stock by the early autumn, the highest pecuniary results are obtained. As a consequence of the experience of the past few months, it seems advisable to insert a strike clause in future contracts for the sale of coke, making it contingent on an unlimited supply of coal.

For some years past, I believe, the gas undertakings in this district have suffered for want of a free market for their tar. It is, therefore, a source of satisfaction to see that the tendency of the larger gas concerns is to take into their own hands the working up of the tar produced by them into its constituent parts. Whether the smaller gas-works should combine to support in each district a tar distillation works of their own, is in my opinion a matter worthy of consideration.

As to the other bye-product, ammonia, it is gratifying to find that the average price for sulphate of ammonia now obtainable is more remunerative than those which have been in force during many years past. The manufacture of sulphate is a process which all except the smallest works should, as a rule, undertake. With a fair volume of storeage for the liquor, the process of conversion need be conducted only at intervals; and the great feature is that two profits are the reward—the one being the saving of transit charges on the ammonia liquor, and the other the makers' profits.

But apart from the financial point of view, it has a singular charm for some minds. The conversion of an offensive liquor into the beautiful white crystals which some of us are so proud to produce, is not without its pleasures. When, however, the sale of the liquor is the course adopted, it is sometimes desirable to concentrate it, so as to have a smaller quantity to transmit.

Liquor ammonia—often obtained from the sulphate—may also be produced direct from the ammoniacal liquor.

The competition between mineral oil and gas is receiving a check in favour of the latter, by the introduction of the prepayment or penny-in-the-slot gas-meter. There are in our towns hundreds—nay, thousands—of householders who are not averse to using gas, but the inevitable quarter's gas bill comes to more than their limited means or improvident habits enable them to meet. Hence they resort to the use of oil, which can be bought in small quantities, and as frequently as is required. The problem which was placed before the inventive mind in the production of the coin-freed meter, was not an easy one to solve; but the plan being so feasible, the makers were pressed for early supplies of such meters. As a consequence, many were issued which were imperfect and had to be returned. It is satisfactory to find that no difficulty need now be experienced in obtaining reliable meters of this class.

My plan thus far is not to supersede the ordinary quarterly consumer, but to take on the prepayment system those only who are exclusively burning lamp-oil, and who have services and fittings in their houses. In this way, the issue of each prepayment meter ensures a new customer for gas; and the outlay on capital account is limited to the cost of the meter. We voluntarily extend our control up to the point of combustion, so as to ensure to the new consumer economical results, by supplying a governor burner rated to pass 4 or 5 cubic feet per hour.

And here I should like to put in a plea for uniformity of practice in the basis of sale and purchase for this class of consumer. Instead of the price being so much per 1000 cubic feet of gas, or even the lower unit of 100 cubic feet, will not the better method of reckoning be so many feet for a penny? If those who are accustomed to burn oil be told that the charge to them for gas would be (say) 3s. 4d. per 1000 cubic feet, they cannot realize its full significance; but inform them that 25 feet are given for 1d., or sufficient to give a good light for six hours, and the meaning is at once understood.

During the past half year, the South Metropolitan Gas Company have fixed 6166 meters of this class. I can confirm the experience of others, that a consumer under the prepayment system burns more gas per annum than he would do if supplied under the usual quarterly credit-payment system.

In pursuance of a liberal policy towards gas consumers for which I plead, all such hindrances to the general use of gas as deposits should, wherever practicable, be dispensed with. There are comparatively few cases in which it is necessary to insist on what may be termed quarterly prepayment. In my own case they do not amount to more than 2 per cent. The class chiefly affected are the tied beerhouse tenant; but of these we are at times able to obtain a guarantee from the brewer, and thus dispense with a deposit. The payment of ordinary interest for deposit money should never be omitted.

On looking over the accounts of various gas companies, I am struck with the fact that high rates of interest for loan money continue in some instances to be paid. As a contrast I may cite the case of the Company with which I am connected, which has for years obtained its loans on mortgage at 3½ per cent. per annum, subject to six months' notice on either side; and now they are in process of being converted into 3¼ per cent. loans. In other words, it is found that statutory gas companies, being able to give security of the highest order, can borrow upon terms approximately equal to those prevailing with local authorities. As any saving in this direction is a clear gain, full advantage should be taken of it.

It is satisfactory to find that the use of gas for motive power, cooking, and warmth continues to extend, and that the apparatus is constantly being improved. An undoubted stimulus to the public to adopt gas apparatus is the holding of periodical exhibitions. Their influence seems to extend long after the time they are held. I have some regret that it should be necessary to adopt this mode of helping the public to make up their minds as to what they want; but it has this compensation, that when they are once persuaded to adopt gas apparatus, they seldom discontinue its use.

The shape of the ordinary gas cooker—that is, with the oven beneath the grill and boiling burners—seems to have been designed more with regard to its compactness than convenience in working. Where circumstances admit, it will be better to place the oven and hot-plate side by side; the oven being so elevated that the attendant has not to adopt a rectangular posture. In order to give an adequate supply to all day consumers, I have adopted a minimum pressure on the mains of one inch. Notwithstanding the advances which have been made in the utilization of coal gas for cooking, heating, ventilation, and motive power, its use as a light-giving medium will, we believe, continue to be the mainstay of gas manufacturers. In no department into which the business naturally divides itself has there been greater progress than in the development of the light which is in the gas. For a long time, it was thought that the utmost light-giving power was that shown by the standard burner as prescribed for testing. Then, with the advent of the regenerative system as applied to burners, the candle power per cubic foot of gas increased by leaps and bounds; and now we are confronted with a further increase by the employment of a burner which—acting on the principle of the Bunsen burner—raises a refractory substance to a high state of incandescence. The first cost of the burners, and the fragility of the mantles (which have to be renewed two or three times a year), somewhat opposes their more general adoption; but even with these drawbacks, it must be admitted they have entered on the practical stage. I cannot withhold a word of praise for a burner which has shown the high possibility there is in the production of light from coal gas.

Perhaps the highest type of gas-lighting is that which, whilst developing to a considerable degree the light-giving property of the gas, does so without vitiating the air of the room which is lighted. If to this be added the further effect of withdrawing part of the air of the room, the double purpose of lighting and ventilation is secured. Of this class of burner, some of the regenerative system are worthy of more extended adoption.

Gentlemen, we have on our list of members many who have practical daily experience with some of the newer processes to which I have referred in the course of this address. I invite them, in your names, to give us on an early date the benefit of their observations so that the year on which we are just entering may be fruitful for good to the members of our Institution, to the authorities whom we serve, and to the great industry with which we are all connected.

Mr. T. Duxbury (Darwen) proposed a hearty vote of thanks to the President for his address. Mr. Braddock, he said, had given them an admirable address, based on personal experience—an address to which they could turn subsequently, and from which they could gather much which might be put into practice. Although the time for his occupancy of the chair had been long delayed—perhaps because of Mr. Braddock's unassuming conduct—yet now that the time had come he would no doubt discharge the duties admirably.

Mr. C. Armitage (Lancaster) seconded the motion.

Mr. J. Hepworth (Carlisle) supported it. He said it was an excellent rule that the President's address should not be discussed; but this rule fortunately did not prevent them expressing their admiration of it.

Mr. Newbigging said it was an interesting, useful, and practical address. Mr. Braddock had thrown a very "wide net," and had gathered a number of subjects into it. On each of these subjects he had given them a useful hint or commentary; and he (Mr. Newbigging) was sure that they would find it useful for purposes of reference in times of doubt or difficulty.

Mr. I. Carr also endorsed the sentiments expressed as to the excellence of the address. He remarked that, as a prospective occupant of the chair, he considered it a very excellent arrangement that the President should be able to say what he pleased in his address without being challenged by any of the members afterwards.

The motion was carried; and the President briefly acknowledged it.

Votes of Thanks.

Mr. W. Carr (Stalybridge) proposed a vote of thanks to the Committee for their services during the past year. It was seconded by Mr. W. Taylor (Glossop) and carried.

The President then moved that the thanks of the Institution be given to the Past-President (Mr. Chester) for his services during the last twelve months. He referred to the masterly address delivered a year ago by Mr. Chester, and to the unique two days' visit which the members paid to Nottingham, as features which would render the ex-President's year of office memorable in the history of the Institution.

Mr. J. Chadwick (Oldham) seconded the motion. He said Mr. Chester had not only served them well during his term as President, but for many years previously as Vice-President and as a member of the Committee.

The resolution was carried by acclamation.

Mr. Chester, in reply, said that if he had done anything to contribute to the interest of the Institution or the pleasure of the members, the gratification which he had received from being their President, and from the kindly consideration which had been shown to him by every member of the Institution would be a pleasure which he should long be able to recall. He had no doubt that they would accord the same kindness and consideration to the present President as they did to himself; and, if that were so, Mr. Braddock's retirement from office would be as pleasurable as his own had been that day.

This concluded the formal proceedings, and the members afterwards had tea together.

Death of Dr. Prix, of Vienna.—The recent death is announced of Dr. Prix, Burgomaster of Vienna. He first occupied a seat in the Municipal Council in 1869; and in 1889 he was elected to the higher office, which he held till his death. Deceased, who was in his 58th year, took a prominent part in the reorganization of the Municipality and its financial affairs, as well as in the extension and improvement of the town, the provision of a new water supply, &c.

The Work of the Sheffield Corporation Water Department.—At a recent meeting of the Sheffield Town Council, it was resolved that, with the view of enabling the Water Engineer (Mr. E. M. Eaton, Assoc.M.Inst.C.E.) to give undivided attention to the work at the Damflask reservoir, and other engineering work, Mr. Terrey should, for the future, take the entire management of the commercial department of the water undertaking—consulting Mr. Eaton whenever necessary.

THE ACTION OF HEAT UPON ETHYLENE.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

[A Paper communicated to the Royal Society, through Professor Thorpe, and read by the Author on Feb. 1, 1894.]

(*Concluded from p.* 382.)

It will be noticed that, with the rate of flow employed in the experiment shown in Table I.,* the largest amount of acetylene found in the gas after heating was 3·60 per cent., which occurs just at the temperature when carbon begins to deposit freely, and is therefore sufficiently high to check the polymerization of the acetylene. Many attempts were made to find conditions under which the acetylene could be liberated and prevented from polmerizing; and it was found that this could apparently be effected, to a certain extent, either by diluting the ethylene with a considerable volume of an inert gas, or else increasing the rate of flow through the heated tube.

On heating a mixture of 75 per cent. of hydrogen and 25 per cent. of ethylene through the tube, heated as before, 3·43 per cent. of acetylene was produced, which would be equivalent to 13·72 on the ethylene present; while the following results show the effect of increasing the rate of flow of the gas through the tube. The original gas taken was a bad sample containing 87·49 per cent. of ethylene and 12·51 per cent. of nitrogen; and the rate of flow was increased to 15 c.c. per minute, the tube being heated to 1250° C.

	Per Cent.
Unsaturated hydrocarbons	10·41
" " containing acetylene	4·49
Saturated hydrocarbons	34·00
Hydrogen	41·99
Nitrogen	9·11
	100·00
Increase in volume	Large
Carbon and oil deposited	0·006 gramme per 100 c.c.

showing a very marked increase in the amount of acetylene formed.

Before it was possible to trace the primary action taking place during the heating of ethylene, it was necessary to find how the temperatures and methods I was employing affected pure methane, which plays so important a part among the products of decomposition. Methane was prepared by acting on methyl iodide by means of the copper-zinc couple in the presence of alcohol and water.

TABLE IV.—*The Action of Heat upon Flowing Methane.*

Percentage of methane in the original gas	99·20	99·20	99·20	99·20
Temperature of gas in the decomposing-tube	1000° C.	1200° C.	1300° C.	1500° C.
Analysis of gas after heating—				
Unsaturated hydrocarbons	trace	0·07	0·39	1·20
Containing acetylene	trace	0·07	0·39	0·963
Saturated hydrocarbons	97·65	90·00	88·52	19·22
Hydrogen	1·55	8·53	10·37	78·66
Carbon deposited and oil formed, grms per 100 c.c. of gas—				
Carbon	0·00	0·00	trace	0·015
Oil	0·0023	0·0025	0·0005	0·00

These results show how much more stable methane is under the influence of heat than any of the other gaseous hydrocarbons studied. It probably decomposes at first into acetylene and hydrogen, according to the equation—

$$2CH_4 = C_2H_2 + 3H_2;$$

and then the acetylene either polymerizes or decomposes to carbon and hydrogen, according to the temperature.

These results also explain why it is that the flame of methane, when burning at an open tube, is practically non-luminous, as, under these conditions, the maximum temperature of the flame is below 1100° C., and no formation of acetylene takes place; while with increase of temperature, the flame becomes rapidly more and more luminous, so that, when burnt in a regenerative burner at 1500° C., the light emitted is of considerable illuminating value.

As a further step in securing factors by which to trace the decomposition, it seemed advisable to attempt to trace the action of heat upon the benzene vapour formed by the polymerization of the acetylene; and in order to do this, pure hydrogen was allowed to pass through benzene at a known rate and a constant temperature—the amount of benzene in the gas being determined.

TABLE V.—*The Action of Heat upon Hydrogen-borne Benzene.*

Percentage of benzene in original gas	5·28	5·28	5·28
Temperature of gas in the decomposing-tube	900° C.	1100° C.	1300° C.
Analysis of the Gas after Heating.			
Unsaturated hydrocarbons	5·00	3·33	2·43
Containing acetylene	0·00	trace	0·083
Saturated hydrocarbons	0·00	2·87	5·02
Hydrogen	95·00	93·80	92·47
Carbon Deposited and Oil Formed in Grammes per 100 c.c. of Gas.			
Carbon	0·00	trace	0·01
Oil	trace	0·012	0·00

which shows that the diluted benzene breaks down to acetylene, methane, and carbon, and finally to carbon and hydrogen.

Taking the experimental data, it seemed to show that the primary reaction on heating ethylene is the splitting up of three molecules into acetylene and methane—

$$3C_2H_4 = 2C_2H_2 + 2CH_4;$$

that the acetylene then polymerizes into higher bodies, as—

$$3C_2H_2 = C_6H_6;$$

and that these compounds, by further polymerization and interactions among themselves, of the kind studied by Berthelot and Carnelley,* give rise to a large number of others. As the temperature rises, the methane formed in the primary action splits up into acetylene and hydrogen—

$$2CH_4 = C_2H_2 + 3H_2;$$

and when the temperature has reached the decomposing-point of the acetylene, which varies with the degree of dilution, polymerization takes place no longer, but the acetylene splits up directly into carbon and hydrogen. All the products formed at lower temperatures doing the same thing, the final reaction is—

$$C_2H_4 = C_2 + 2H_2.$$

An attempt was now made to see how far analytical results would quantitatively bear out the inferences deduced from the foregoing experiments. To do this, the method adopted was as follows: The whole apparatus was filled with ethylene. The platinum and condensing tubes were weighed, and the amount of ethylene in the gasholder measured. The platinum tube was heated to the required temperature, and the gas aspirated through it at a uniform rate of 4·2 c.c. per minute. When sufficient gas had passed through (about 250 c.c.), the stopcocks were turned off, and the quantity of gas left in the holder measured. The amount of water displaced from the aspirator was also measured; and in this manner the change in volume was determined. The tube was again weighed, and the gain in weight noted. The platinum tube was also weighed, and then slowly heated to dull redness in a stream of hydrogen, in order to drive off any oil that might have been condensed in it, and again weighed. The tube was now heated to bright redness in a stream of oxygen, in order to burn off carbon, and again weighed. The sample tube was closed, and the contents analyzed; the acetylene in the absorption bottles was also determined in the usual way.

Ethylene was first heated to 700 to 800° C.; but no acetylene was formed, no alteration in volume took place, and the gas seemed unacted upon. The temperature was then raised to 800 to 900° C., and the following results were obtained:—

Oil	0·0131 gramme per 100 c.c. of gas.	
Heavy oil	0·0055 " " "	
Carbon	Nil	
Decrease in volume	100 to 89	
Acetylene formed	0·057 per cent.	
On analysis the gas gave—		
(1) Acetylene	0·06	
Unsaturated hydrocarbons	81·38	
Paraffins	6·66	15·83
Marsh gas	9·17	
Hydrogen	0·00	
Nitrogen	3·10	
	100·37	
Original gas—		
Ethylene		98·03
Nitrogen		1·97
		100·00
Analysis without paraffin absorption—		
(1) Acetylene		0·06
Unsaturated hydrocarbons		81·25
Saturated hydrocarbons		17·70
Hydrogen		0·00
Nitrogen		3·10
		102·11

0·0186 gramme of oil = 17·3 c.c. of acetylene at 17° C. and 760 mm.; 100 volumes of gas after heating condense to 89 volumes of gas and 15·4 volumes of acetylene.

Calculating the analysis from a percentage to a basis of 89, we get—

Acetylene	0·05
Unsaturated hydrocarbons	72·41
Saturated hydrocarbons	14·00
Hydrogen	0·00
Nitrogen	2·76
	89·22

Taking 72·41 from 98·03 = 25·62 of ethylene decomposed; and (according to the equation $3C_2H_4 = 2C_2H_2 + 2CH_4$) 25·62 should give—

Calculated	17·0 vols. of acetylene and 17 vols. of methane.
Found	15·4 " " 14 " "

The discrepancy in the figures is due to interactions between the products of decomposition; and the result would certainly seem to point to the above equation as representing the initial decomposition.

The next temperature tried was 900° to 1000° C.; and the following figures were obtained:—

Rate of flow	4·2 c.c. of gas per minute.
Oil	0·0213 gramme per 100 c.c. of gas.
Heavy oil	0·0080 " "
Carbon	0·0363 " "
Decrease in volume	100 to 98·6.

* See *ante*, p. 381.

* *Chem. Soc. Jour.*, Vol. XXXVII., p. 701.

On analysis, the gas gave—

(1) Acetylene	1·19	
Unsaturated hydrocarbons	15·21	
Paraffins	12·70	40·48
Methane	27·78	
Hydrogen	41·30	
Nitrogen	1·82	
	100·00	

No paraffin absorption—

(2) Acetylene	1·19
Unsaturated hydrocarbons	15·43
Saturated hydrocarbons	40·77
Hydrogen	40·79
Nitrogen	1·82
	100·00

Explosion of the whole—

Carbon dioxide	73·73 per cent.
" " calculated from (1)	73·28 "
" " " " (2)	73·96 "

0·0363 gramme of carbon = 36·3 c.c. of acetylene at 19° C. and 762 mm.
0·0293 gramme of oil = 27 c.c. of acetylene at 19° C. and 762 mm.

Calculating these from 100 c.c. of gas to 98·6 c.c. of gas, we get—

Oil	= 26·8 c.c. of acetylene at 19° C.
Carbon	= 35·8 c.c. " "

And calculating the gas analysis in the same manner as before, we obtain—

Acetylene	1·17
Unsaturated hydrocarbons	15·00
Saturated hydrocarbons	39·90
Hydrogen	40·72
Nitrogen	1·81
	98·60

Then the amount of ethylene decomposed is 98·03 − 15·00 = posed: 83·03; and this should give.

$$3C_2H_4 = 2C_2H_2 + 2CH_4$$

83·03	55·35	55·35 calculated.
	62·60	39·90 found.

Evidently, therefore, some of the methane has decomposed, forming acetylene and hydrogen. Amount of methane decomposed: 55·35 − 39·90 = 15·45.

$$2CH_4 = C_2H_2 + 3H_2.$$

15·45	7·72	23·16

Adding this acetylene to that already calculated for the decomposition of ethylene, we get 55·35 + 7·72 = 63·07—a figure nearly equal to the acetylene found.

Taking into consideration the complexity of the changes involved, and the difficulty in obtaining great accuracy in gas analysis, these results seem to me to prove that the primary action of heat upon ethylene may be represented by the equation—

$$3C_2H_4 = 2C_2H_2 + 2CH_4;$$

while the final decomposition is as represented by previous observers—

$$C_2H_4 = C_2 + 2H_2;$$

and that between these two extremes, there occur a large number of interactions due to the polymerization of the acetylene formed from the ethylene, and also at higher temperatures from the methane, according to the equation—

$$2CH_4 = C_2H_2 + 3H_2.$$

In conclusion, I desire to acknowledge my indebtedness to Mr. F. B. Grundy for the assistance he has rendered me in this investigation.

THE CHEMICAL TECHNOLOGY OF COAL GAS.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

[A Course of Lectures delivered at the Stratford Town Hall.]

VI.—*The Consumption of Coal Gas for the Generation of Light.*

Of all the many questions which at the present time affect the coal gas industry, there is probably none of more importance than the method by which gas is consumed. The Companies in London are tied down by the Legislature to supply gas of an illuminating power of 16 candles; and when we come to consider what this in reality means, we find that, by one of those subtle strokes of humour in which our legislative body occasionally indulges, it means to the consumer almost anything except a light equal to 16 candles. The amount of illumination which can be obtained by the consumption of coal gas is entirely dependent upon the method by which the gas is burned. From a so-called 16-candle coal gas, the consumer rarely obtains a value of more than 12 candles per 5 cubic feet of gas consumed; while by using burners of rational construction, upwards of 40-candle illuminating power could be obtained for the same consumption of gas. In order to understand the causes which lead to this anomaly, we must first trace the actions which endow flames with luminosity; and, although a certain amount of doubt still exists on some of the minor details of the actions taking place in a luminous flame, the general course of the main causes which lead to luminosity are fairly clear, and we can obtain an insight into the methods best adapted for developing the highest possible amount of light from our gas.

In the year 1816, Sir Humphry Davy, while engaged upon the celebrated researches which culminated in the discovery of the miner's safety-lamp, noticed certain facts which led him to work out and propound his theory of the causes which lead to luminosity in flame—a theory which is generally stated as being that the presence of solid particles is essential to such luminosity. In 1868, however, this theory was attacked by Professor E. Frankland, in a paper read before the Royal Society, in which he showed that, although solid incandescent matter in a flame renders it luminous, luminosity is also in many cases produced when the flame contains very dense vapours at a sufficiently high temperature, and also that a non-luminous flame may be rendered luminous by increasing the pressure. This theory at once evoked considerable criticism; and for the next few years a large amount of work was done on the subject. Professor Frankland not only showed that flames might be luminous without containing solid particles, but advanced the theory that the luminosity in the flame of a burning gaseous hydrocarbon was due to dense hydrocarbon vapours. He also pointed out that the soot deposited on any cool surface held in the flame contained hydrogen. In answer to this, W. Stein showed that the deposited soot contained less than 1 per cent. of hydrogen, so that probably it was only occluded by the carbon; and that, if it had been present as vapour in the flame, it ought, on being heated to the same temperature as the flame, to be once again volatile, which is certainly not the case. Soret, in 1874, attempted to ascertain the truth of Frankland's theory by focussing the sun's rays upon a luminous flame, and examining the reflected light by means of a Nicol prism. He was followed by Burch, who, however, employed the spectroscope for his examination of the reflected light. The result of their experiments undoubtedly showed the presence of solid particles; and, at the present time, Davy's theory, as far as the flames of candles, oil, and gas are concerned, is very generally accepted as the correct one.

While this discussion was going on, Hilgard, Landolt, Blochmann, and Heumann were devoting their attention to an examination of the chemical actions taking place in the flame, and the causes which lead to loss of luminosity when air is mixed with gas before consumption, as in the Bunsen burner. Heumann found as a further proof to the "solid particle" theory, that all flames which owe their luminosity to incandescent particles of matter give definite shadows, whereas those flames in which the luminosity is due to dense vapours give none; and that candle, oil, and gas flames all give well-defined shadows. The work of Soret, Burch, and Heumann proves beyond doubt that our ordinary illuminating flames contain, in the luminous zone, particles of solid matter; and the only solid which could be present is carbon, either pure or containing the merest trace of hydrogen. The chief question now remaining to be solved is consequently the action taking place which leads to the formation of the solid particles in the luminous zone of the flame.

The result of analyses made by Landolt of gases which were withdrawn from various parts of a coal-gas flame, and also of a long series of analyses which I have made, show that, as the gas leaves the burner, the hydrogen is the first to be consumed, and that, in the passage up the non-luminous part of the flame, the carbon monoxide largely increases in quantity; while at the same time the methane rapidly decreases, and the unsaturated hydrocarbons seem to be the least affected. In the luminous zone, the unsaturated hydrocarbons rapidly disappear; while the carbon monoxide formed in the inner zone, and also the residual hydrogen and methane, undergo combustion. Professor Smithells, in a paper read before the Chemical Society in December, 1891, also proved that, during the incomplete combustion taking place in the inner cone of a Bunsen flame, this same increase in the amount of carbon monoxide was to be observed. The fact that the decrease in quantity of the unsaturated hydrocarbons was but slow in the inner zone, and then took place with considerable rapidity in the luminous zone, favoured the theory that they were broken up by heat in that portion of the flame, and liberated the carbon, which by its incandescence gave the luminosity. But it does not seem to have occurred to anyone to try and determine whether the unsaturated hydrocarbons at the top of the non-luminous zone were of the same description as those in the coal gas.

It is a matter of common observation that the checked combustion of a luminous flame at once gives rise to the escape of acetylene, and also that, if a Bunsen burner catches light at the bottom, large quantities of acetylene are formed, the presence of which is at once detected by its distinctive and pungent odour. These facts suggested the idea that, in the inner cone of the flame, acetylene might be formed by decomposition of the original hydrocarbons. Experiment at once showed this to be the case. The gas was burnt at the end of an open tube; and the flame gases were aspirated from the centre of the flame by means of a small platinum tube 2 mm. in diameter, and were led into a glass bulb tube, in which the sample for analysis of the total hydrocarbons was collected, and then through two Volhard's absorbing-bottles, containing 20 c.c. of concentrated ammoniacal silver nitrate solution. This absorbed the acetylene, with formation and precipitation of silver acetylide and silver; the latter being formed owing to the reducing action of the carbon monoxide. Two absorbing-vessels were quite sufficient to prevent any trace of the gas

from escaping absorption. The contents of the two bottles were filtered, the precipitate of silver acetylide was carefully washed, and then treated on the filter very cautiously with dilute hydrochloric acid until all action ceases. Acetylene was given off, and the precipitate then consisted of silver chloride mixed with metallic silver. This after washing was digested with dilute ammonia; and the ammoniacal solution, after filtration, was treated with nitric acid to precipitate the chloride, which was weighed in the usual manner—1 gramme of silver chloride corresponding to 0·09 gramme or 87·03 c.c. of acetylene.

Acetylene Formed during the Incomplete Combustion Taking Place in the Interior of a Luminous Flame.

	Total Unsaturated Hydrocarbons. Per Cent.	Acetylene. Per Cent.
Gas in burner	4·38	0·035
½ inch above rim of burner	4·00	0·340
1½ inches " "	1·53	0·560
Tip of inner cone	1·98	1·410
Centre of luminous zone	0·45	0·450
Tip of luminous zone	Nil	Nil

These figures show that in the interior of the luminous flame the hydrocarbons at once begin to decompose, forming acetylene, which, by the time the top of the inner non-luminous zone is reached, constitute over 70 per cent. of the unsaturated hydrocarbons present. A small proportion of the other hydrocarbons present remains undecomposed, and penetrates into the luminous zone, where it and the acetylene are both decomposed by the higher temperature attained. Carbon is liberated; and this, being for a moment heated to incandescence, gives luminosity to the flame.

The next analyses were taken from a flat flame—the gases being withdrawn and analyzed as before.

Acetylene Formed in the Inner Zone of a Flat Flame from a No. 7 Bray Burner.

Portion of Flame.	Total Unsaturated Hydrocarbons. Per Cent.	Acetylene. Per Cent.	Other Unsaturated Hydrocarbons. Per Cent.
½ inch from top of burner	3·565	0·115	3·450
1¼ inches from burner	2·063	1·303	0·760
1¾ " "	1·393	1·133	0·260
2¼ " "	trace	trace	—

These figures show that, by the time the top of the non-luminous portion was reached, upwards of 81 per cent. of the hydrocarbon present had been converted into acetylene.

Luminosity in such a flame commences just above the 1¾ inches from the burner; and the question arises: If luminosity be caused by the acetylene, why should it not have commenced at 1¼ inches, for in this place the acetylene is present in larger quantity than at the higher point? The answer to this is that, in order to obtain luminosity, a certain temperature must be attained, so as to decompose the acetylene; and the point at which this decomposition commences is the one where the luminosity of the flame starts. If this temperature is not reached, the acetylene in the presence of oxygen burns away with a non-luminous flame, or if no oxygen be present polymerizes into a number of higher hydrocarbons. But if the necessary temperature is reached, and the acetylene dissociates, the liberated carbon becomes incandescent, chiefly from its own combustion, and partly also from the combustion of the hydrogen liberated at the same time, and luminosity is the result. Accordingly, as the degree of dilution of the acetylene varies, so does the temperature necessary for its dissociation change. The more diluted it is, the higher the temperature needed; while with a large percentage of acetylene, a lower temperature is required for its dissociation, and the smaller, therefore, is the inner non-luminous zone of the flame.

Only from 1·1 to 1·3 per cent. of acetylene is found in the inner zone of a flame of ordinary coal gas, and as this is in a highly diluted condition, it requires a temperature of close upon 1200° C. to break it up; while in other flames, richer in hydrocarbons, and therefore richer in acetylene in the inner zone, the temperature required is not so high. For example:—

	Flame of Coal Gas.	Flame of Paraffin Lamp.
Percentage of acetylene	1·133	2·222
Temperature at commencement of luminous zone	1267° C.	1062° C.

The fact that the acetylene burns away with a non-luminous flame unless the necessary temperature is attained is, I think, shown by the following experiment: The flame of burning alcohol contains more than half the quantity of acetylene a good gas-flame does, and yet the combustion is practically non-luminous. If a dish containing some alcohol be placed under a bell jar, it burns with a flame having slightly luminous edges, and the temperature of the flame in this condition is 1220° C. If now a glass plate be put over the mouth of the bell jar for a few moments, the mixing of the products of the air with the products of combustion lowers the rate of combustion, and the temperature of the flame falls to 1050° C.; the flame becoming perfectly non-luminous. If, however, oxygen be admitted to the bell jar, the combustion is increased, and the temperature rapidly rises to 1510° C.; the flame becoming nearly as luminous as a coal-gas flame, and depositing carbon on any cold surface held in it. Again, if a small luminous gas-flame be allowed to play on the bottom of a platinum dish, so much heat is abstracted from the flame that the temperature falls below the point necessary to break up the acetylene, and the flame becomes non-luminous; while if the flame is allowed to remain in contact with the metal until the dish is red hot, the luminosity returns. The same effect may be produced by heating the interior of the dish with a blowpipe flame. This experiment was devised by Heumann to show the effect of cooling on luminosity. In every flame I have examined which owes its luminosity to the presence of hydrocarbons, these bodies are converted into acetylene before luminosity commences in the flame; and every gaseous hydrocarbon which can by heat be made to deposit carbon is converted into acetylene before any deposition takes place.

Many of the hydrocarbons present in coal gas are known to give out heat during their decomposition; but probably the most endothermic of these compounds is the acetylene—Thomsen having shown that no less than 55,010 units of heat are absorbed in the formation of 26 grains of acetylene, while only 10,880 units disappear in the production of 28 grains of ethylene. It is this which renders so easy its decomposition by heat, or, as shown by Berthelot, even by detonation, into carbon and hydrogen. The fact that acetylene is formed from the gaseous hydrocarbons present in illuminating gas prior to the emission of light does not, however, in any way, by itself, disprove Frankland's theory that luminosity is due to very heavy hydrocarbon vapours, and not to solid particles of carbon, as the well-known tendency of acetylene to polymerize into higher bodies might be taken as the explanation of the presence of sufficiently dense hydrocarbons in a flame given by (say) pure ethylene.

In order to determine whether or not the acetylene formed in the earlier stages of the flame renders the flame luminous by liberating carbon during dissociation, as required by Davy's theory, or by forming heavier hydrocarbons, a long series of experiments was made to ascertain the effect of heat upon the hydrocarbons present in coal gas, and, by specially-devised apparatus, to measure the actual temperature to which the gases were being heated, and to collect and analyze the resulting products. Ethylene passed at the rate of 4 to 5 c.c. per minute through a tube 2 mm. in internal diameter undergoes no apparent change until the temperature rises to between 800° and 900°C. It then breaks down to methane and acetylene; and, simultaneously with the formation of acetylene, heavy vapours appear which can be condensed, and in which benzene and naphthalene are conspicuous, as well as a heavy and highly fluorescent oil of high boiling-point. Berthelot found that these substances were formed when acetylene was heated for some time at a temperature at which glass softens; and he also recognized among the products cinnamene (C_8H_8) and retene ($C_{18}H_{18}$). So that there seems very little doubt that, by passing the ethylene through a heated space in which the temperature does not rise above 900°C., methane and acetylene are first formed, and the latter at once polymerizes into the heavier hydrocarbons. The amount of acetylene found in the products of the experiments rarely exceeds 1 per cent., as the polymerization occurs almost simultaneously with the formation; but the proportion of ethylene decomposed, and the quantity of methane found in the products of decomposition, point to the initial action of heat at this temperature, being—

$$3C_2H_4 = 2C_2H_2 + 2CH_4.$$

When the temperature is raised from 900° to 1000°C., the same action continues—no hydrogen appearing in the products of decomposition, and no carbon is deposited; but the formation of oil and solid hydrocarbons is more abundant. Between 1000° and 1100°C., a trace of hydrogen appears, and a little carbon begins to deposit with the oil; this increasing with rise in temperature up to between 1300° and 1400°C., by which time all formation of oil has ceased. Carbon is deposited in larger quantities; and the residual gas consists of hydrogen, with a little methane. The temperature at which oil disappears is about 1200°C.; and the proportion of acetylene formed at this temperature is larger than at any of the lower ones.

It is evident, therefore, that if the temperature existing in the luminous portion of the flame exceeds 1200° C., the luminosity cannot be due to such hydrocarbons as are formed from the acetylene, but that carbon will be present in abundance. I have made several analyses of the carbon so deposited, and find that the hydrogen in it varies from 1 to 3 per cent.; and as there is no fixed ratio, I think there is not the slightest foundation for imagining it is in combination. Indeed, Stein's work upon this point is fairly conclusive; and anyone who has attempted to prepare hydrogen-free carbon from sugar or other similar body, will realize the intense power which freshly liberated carbon has of occluding and holding hydrogen.

The temperatures existing in the flat flame in which I had traced out the changes taking place in the constituents of the gas, rapidly rise from 500° C., half an inch above the burner, to a little over 1200° C. at the commencement of the luminous zone—the luminous edges having a temperature of 1216° C.; and these temperatures are further increased in the luminous zone, until near the top of the flame 1368° C. is reached. This at once gives us the secret of the luminosity. From the mouth of the jet, and up to a temperature of 1000° C. to 1200° C., we have the formation of acetylene from the original hydrocarbons; but the moment the requisite temperature is reached by the combustion of the hydrogen and the carbon monoxide, the acetylene decomposes, with a further rise of temperature, and the carbon, heated to incandescence, radiates light and heat.

In the experiments with the hydrocarbons, the gases were

passing through a heated space 6 inches long kept at a constant temperature, whereas in the flame they are passing through a space 1·75 inches long with a rapidly increasing temperature; so that, instead of the acetylene becoming polymerized to any great extent, it reaches a temperature at which dissociation takes place almost as soon as it is formed. Experiments with hydrogen-borne benzene vapour show that, at a temperature of 1200° C. to 1300° C., it is reconverted to acetylene; and this at once breaks down to carbon and hydrogen. The same happens with any other heavy vapours produced in the inner zone. These bodies, formed probably in minute quantities by polymerization, together with any remaining methane, are reconverted into acetylene, and deposit their carbon as soon as the necessary temperature is reached; and this supplies a fresh quantity of carbon particles to the upper portion of the luminous zone, and so increases its size.

The careful analyses of Hilgard, Landolt, and Blochmann, made to determine the interactions taking place in various flames, are, in their main characteristics, in close accordance with a long series and analyses of flame gases which I have made; and one of the most striking features of these is the comparatively slow rate at which the heavy hydrocarbons disappear, as compared with the other constituents of the original gas. This I find to be chiefly due to diffusion, which causes the hydrogen and methane to find their way to the outer skin of the flame first; and it is these bodies, therefore, which bear the brunt of the earlier combustion, and yield the heat which bakes the heavy hydrocarbons, ascending straight up from the burner, into acetylene. If three concentric tubes be placed half an inch above an open tube from which coal gas is issuing, and the gas from each is withdrawn and analyzed, it will be found that, on comparing them with the original gas, the action is most marked; the gas in the outer tube being practically a mixture of air with hydrogen, while in the inner tube the unsaturated hydrocarbons have risen from 3·56 to 4·53 per cent. All analyses of the flame gases show that the hydrogen burns first, and that next in rapidity of burning is the methane.

As may easily be imagined, the first burner used for the consumption of coal gas was the end of the tube from which it was issuing; but Murdoch, the "father" of gas lighting, soon saw that the consumption was far too high, and the illuminating value far too low, to make this a successful method of burning his new illuminant. Casting about to find a method of retarding the flow, he fitted an old thimble over the end of the pipe; and this happening to have several pin-holes in the crown, he lighted the gas issuing from them to prevent it escaping into the room. He at once found that several small jets gave a far better light than one big flame, besides causing considerable economy in the consumption of gas. But as his experiments progressed, the form of his burner was modified, until in 1807, when fitting up the works of Messrs. Phillips and Lee, in Manchester, he used two forms of burner—the one a rough Argand, and the other "a small curved tube with a conical end, having three circular apertures or perforations about 1-30th of an inch in diameter (one at the point of the cone, and two lateral ones), through which the gas issuing formed three divergent jets of flame, somewhat like a fleur-de-lys." The latter burner, which, from the shape of the jet, received the name of the "cockspur" burner, gave a light equal to 2¼ mould candles of six to the pound; while the Argands used developed a light equal to 4 candles of the same description. The Argand burner had been in use for the consumption of oils for some years before the introduction of coal gas; and in its early form it consisted simply of two concentric tubes fixed at the required distance apart—the coal gas being fed in between them. Soon, however, the idea arose of closing the open circular slot by a metal ring pierced with holes, so as to give a circle of small jets; and even prior to 1816, the main principles of our present Argands were found to be in the burners in use. It was about 1816 also that the "cockspur" burner became converted into the "cocks-comb," and then the "batswing;" thus marking a distinct advance in the method of burning the gas, as by spreading the flame out into a thin sheet, instead of having it in a solid mass as in the jet burner, the air was more readily and uniformly supplied to the burning gas, and the higher temperature of the flame, due to the more perfect combustion, increased the light-giving power of the burner to nearly that of the Argands then in use.

In 1820, Nielson, of Glasgow, whose name will always be remembered as the discoverer of the hot-air blast in iron smelting, found that, by allowing two flames to impinge upon one another, an increase in luminosity was obtained; and, after several preliminary stages, the union-jet or "fishtail" jet was produced, in which two holes, bored at the necessary angle in the same nipple, caused two jets of gas to impinge upon each other, so that they mutually splayed themselves out into a flat flame. The batswing flame was a very wide one, of but little height, while the fishtail was much higher and narrower; and although the service yielded by the fishtail for each foot of gas consumed was no better than, even if it was so good as, that given by the batswing, yet its shape, which made it less affected by draughts, and enabled a globe to be used with it, ensured a greater meed of success for it than the batswing burner had secured. The next twenty years was a period of the gradual improvement and perfecting of the Argand and flat-flame burners—the influence of pressure and regulation of the flow of gas to the burner being gradually realized, and arranged for, while other structural improvements were introduced.

On the 20th of May, 1853, Dr. Frankland, while giving one of the usual Friday lectures at the Royal Institution, showed, but did not fully describe, an Argand burner in which the idea was first adopted of utilizing the heat which otherwise would have been lost, to raise the temperature of the air supply; and this burner was afterwards described in Ure's "Dictionary"—the article, however, not being published till a year or so after it had been written. The burner consisted of an ordinary Argand; but, in addition to the usual chimney, it had a second external one, which extended some distance below the first, and was closed at the bottom by a glass plate, fitted air-tight to the pillar carrying the burner, so that the air needed to support the combustion of the gas had to pass down the annular space between the chimneys, and in its passage became highly heated—partly by contact with the hot inner glass, and partly by radiation. The temperature of the air finally entering the burner Dr. Frankland considered to be about 500° Fahr. In 1854, the Rev. W. R. Bowditch brought out a burner identical in nearly every respect with the one just described; and as this was brought prominently forward, it attracted considerable attention, with the result that the inception of the regenerative burner has been generally ascribed to Bowditch, while that honour is undoubtedly due to Frankland.

In 1879, Friedrich Siemens, of Dresden, brought out his large burner, which, although one of the most effective, was also one of the most unsightly from its big overhead feed-pipe. This burner was really first made for heating purposes; but the light it gave was so far ahead of any effect which had been obtained up to that time, that, with certain modifications, it was adopted for lighting purposes. From that time up to the present, regenerative burners—good, bad, and indifferent—have increased and multiplied with great rapidity; the chief differences between them being in their names and slight details of design. About the same time that the regenerative burner was struggling into prominence, Mr. Lewis brought out a burner in which the coal gas was consumed mixed with air, as in a Bunsen burner; and the flame was then urged, by an artificial blast, against a cone of fine platinum wire, which, being heated to incandescence, gave a very high candle power per cubic foot of gas consumed. This was therefore the forerunner of the Welsbach, Clamond, and other incandescent lights.

Having traced the gradual genesis of our present burners, we must now see how they comply with the theories I have laid before you. There are two special points to be observed to produce a luminous flame. First, to use a hydrocarbon that is easily converted into acetylene by means of heat; and, secondly, to have as hot a flame as possible. These two conditions now pointed out by theory have long been known in practice. Gas managers realize that the larger the quantities of olefines, &c., in their gas, the better its candle power; and burner makers have discovered that the regenerative burner gives by far the best results per cubic foot of gas consumed. But why, then, it may be asked, does high temperature retorting give such a poor gas, containing only a trace of acetylene. The reason is that acetylene, heated to a temperature insufficient to decompose it, polymerizes into bodies such as benzene, naphthalene, &c., which go to make the tar better at the expense of the gas. In fact, by passing coal gas through a heated platinum tube, I have been able to obtain naphthalene in considerable quantity; and at the same time the gas has deteriorated, so that superheating the gas itself during manufacture can only end in failure. But supposing it were possible to charge our gas with acetylene, it is so soluble in water or glycerine that it would nearly all be absorbed in the gasholder and meter, and very little would find its way to the burner. So we find that we must depend upon the gas-flame itself for the production of acetylene. The luminosity of the flame results from having the acetylene formed in just the right place to be split up by the greater heat it encounters in passing up the flame.

We have two methods of raising the illuminating power of a gas—either by increasing the amount of acetylene-forming gases (which is expensive), or by regeneration. Regeneration acts in two ways—first by increasing the initial temperature of the flame. Then we have the blue zone decreased in size, because the temperature necessary to split up the acetylene is reached sooner, and therefore less is burnt without decomposition; also the higher the temperature, the more marsh gas is converted into acetylene. Secondly, the inert nitrogen of the atmosphere, being at a high temperature to start with, abstracts less heat from the flame; and therefore the carbon particles are heated to a higher state of incandescence. Through the kindness of Mr. Siemens, I have been enabled to measure the effect of regeneration on a flat flame. The flame when cold had an area of 11 square inches, the luminous portions of which occupied 7·8 square inches, and the non-luminous portions 3·2 square inches. On regenerating the flame, the area decreased to 10·2 square inches; but the luminous zone occupied 7·9 square inches, while the non-luminous zone only occupied 2·5 square inches—the illuminating effect being more than doubled. But regenerative gas-burners, on account of their initial cost, are but little used, at any rate for domestic purposes; and the flat-flame burner is still the popular one. By the use of even the improved forms of flat-flame burners, a great deal of the possible illuminating effect of the gas is lost.

Having now discussed the causes which lead to luminosity in flames, we are in a position to understand the enormous influence which the burner has upon the quantity of light obtained per cubic foot of gas consumed; and, on carefully testing the burners in ordinary use, we find that, for an equal consumption of gas, the results at once show the enormous advantage to be obtained by regeneration, and also how serious is the loss which attends the employment of ordinary burners.

Burner.	Light Obtained per Cubic Foot of 16-Candle Gas Consumed. Candle Units.
Regenerative	10·00
Standard Argand	3·20
Ordinary Argand	2·90
Flat-flame, No. 7	2·44
„ No. 6	2·15
„ No. 5	1·87
„ No. 4	1·74
„ No. 3	1·63
„ No. 2	1·22
„ No. 1	0·85
„ No. 0	0·59

These burners were by well-known makers; but there are plenty of cheap German nipples in the market which will give even worse results. In the above table, No. 7 is the largest flat-flame burner given, as any larger size would never be used for indoor illumination; but with some of the big flat-flame burners employed for outdoor work, as much as 3-candle power per cubic foot of gas is developed by the best make, while it is also quite possible to find cheap imitations of them, which can scarcely be distinguished by their appearance, only developing a little more than 1 candle per cubic foot. It seems probable that 10 candle units represent the maximum light to be obtained in practice per cubic foot from the so-called 16-candle coal gas, as, although greater regeneration will increase it as high as 16 units, the heat is so intense that the burner is quickly destroyed. Taking 10 candle units as being the amount of light for a consumption of 1 cubic foot of gas per hour, we can now form an approximate idea of the waste of illumination which attends the ordinary methods of burning the gas.

If the burners most commonly in use in houses be examined, they will be found to consist chiefly of No. 4 and No. 5 flat-flame nipples; and I do not think I should be over-estimating the number in use if I put them at 85 per cent. of the total. The remaining 15 per cent. are made up of larger flat-flame burners, Argands, and regenerative lamps, which give a higher service; but it will be found that the total value obtained will not exceed 2·5 candles per cubic foot. So that 75 per cent. of the total value obtainable from the gas is wasted, and for our present expenditure in coal gas we could obtain four times as much light.

An Interesting Derivative of Marsh Gas.—The interesting di-nitro derivative of marsh gas, $CH_3(NO_2)_2$, has, according to *Nature*, been isolated in the pure state by Dr. Paul Duden, in the chemical laboratory of the University of Jena. As might be expected, it is a substance of little stability, and many of its metallic derivatives or salts (for the parent substance is endowed with acid properties) are dangerously explosive. The compound itself cannot be preserved, even in sealed tubes, for many hours—becoming converted into gaseous products of decomposition; but its potassium salt, $CHK(NO_2)_2$, is much more stable, and may be kept unchanged for months. The preparation of the acid is best achieved from this potassium salt by decomposing it at a low temperature with dilute sulphuric acid. The potassium salt may be readily obtained by reducing the di-bromine derivative of di-nitromethane by means of an alkaline solution of arsenious oxide. The di-bromine derivative is a substance obtained by distilling tribromaniline with nitric acid. It is added in small portions at a time to the strongly-cooled aqueous solution of the alkaline arsenite, in order to mitigate the violence of the reaction. After the completion of the change, the potassium salt is deposited in small bright yellow crystals, which, by recrystallization from hot water, yield the salt in perfectly pure large monoclinic prisms. The aqueous solution of these crystals is neutral to litmus; the strong acid being neutralized by the introduction of one atom of potassium. At a temperature near 205°, the crystals detonate loudly; evolving a mixture of nitrogen, nitric oxide, and carbon dioxide. Concentrated acids violently decompose the crystals, with evolution of red nitrous fumes; but if they are suspended in iced water, and a layer of ether is spread over the surface, they are quietly acted upon by dilute sulphuric acid with liberation of free di-nitromethane, as above-mentioned. The latter substance is dissolved by the ether; and the dried ethereal solution yields it, after evaporation of the ether, as a yellowish liquid of peculiar acid odour, and which soon begins to effervesce, owing to the elimination of products of decomposition. The free compound may be preserved much longer in ethereal or benzene solution. The silver salt, $CHAg(NO_2)_2$, is the most remarkable of its salts. It crystallizes in bright green tabular crystals, which are extremely sensitive to light. Mere boiling of their aqueous solution is sufficient to produce deposition of metallic silver. Either upon warming or by contact with a drop of hydrochloric acid, the crystals explode with great violence. Upon reduction of the iced solution of the potassium salt by sodium amalgam, a curious substance of the composition CH_3N_3O is produced, which explodes below the temperature of boiling water.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Is a New Gas Undertakings Association Desirable?

SIR,—The article which appeared in the last number of the JOURNAL under the above heading clearly shows why an Association of the kind indicated is "desirable." At the present time, nearly all large private enterprises, except the gas industry, possess associations for the protection of their common interests; the objects of such associations primarily being to act as watch-dogs, and warn the interests concerned of the probability of attack, so as to enable them to rally together in support of their rights.

The Bills introduced into Parliament year by year with, in some instances, the express object of attacking successful private enterprises (particularly gas and water), would in themselves afford scope for useful work. Take for example some of those of last year. The Rating of Machinery Bill, which was read a second time in the Commons, proposes to exclude certain machinery, &c., from being taken into account for the purpose of estimating the value of premises for rating. Clause 2 of the Bill, however, provides that it shall not apply to the rating of water-works or *gas-works*. What good reason can there be why water and gas undertakings should be excluded from the Bill, when other enterprises, including electric lighting, &c., are to have the benefits of it? The Local Authorities (Acquisition of Land) Bill proposed to empower local authorities to acquire land by agreement or compulsorily within two miles of their district, for the purpose, among others, of *gas-works*. If this Bill became law, it might possibly be held to override the protection which a gas company now have under the Public Health Act against competition from a local authority. The Hours of Labour (Crown, &c., Servants) Bill proposed that *no person* employed by, among others, *any gas company* should, except in case of special unforeseen emergency (as to which the President of the Board of Trade was to be judge), be employed for a longer period than eight hours a day, and that any contravention of the Act was to render the general manager of the company liable to a fine of £50. The effect of this proposed enactment can, no doubt, be appreciated by those concerned.

The above are only a few of the many similar cases which have lately come under my notice. The interests of gas companies, as regards any alteration in their present legal position, are identical throughout the kingdom; but it seems to me that the duty of protecting these interests is generally left to whatever company may think fit to come forward, and, at their own expense, do battle for them. This was the case last year with regard to the proceedings before the Joint Committee on Electric Powers (Protective Clauses); and at the present time, when the Board of Trade is engaged in settling their regulations to carry out the recommendations of that Committee for, among other matters, "preventing fusion or injurious electrolytic action of or on gas or water pipes," no joint action appears to have been taken by gas companies. In the article before referred to, you state, alluding to the period of about 1879, that "the age had passed when gas and water companies could be satisfactorily dealt with as possessing identical interests." This, no doubt, is strictly accurate; but, on the other hand, their interests are not likely to clash. The Bills before referred to affected both gas and water undertakings in a precisely similar manner, and both are equally liable to joint as well as to separate attacks in the future. I may add that the cost of carrying on such an Association as that suggested would be infinitesimal compared with the vast interests it would be its duty to protect.

18, *Abingdon Street, Westminster, March* 2, 1894. R. L. S. BADHAM.

City of St. Petersburg New Water-Works Company, Limited.—At the 21st ordinary general meeting of this Company, which will be held to-day at the Cannon Street Hotel, the Directors will report that after long and careful investigation, the Douma (Town Council) of St. Petersburg have finally approved the accounts, and confirmed the annuity payable to the Company at the sum of 166,601·91 roubles, payable by half-yearly instalments. The instalments due have been punctually met. The Directors are advised that, before a dividend can be paid on the shares, the adverse balance on the accounts must be provided for. The most convenient way of doing this will be by reducing the nominal amount of the share capital. The assets of the Company, on a moderate calculation, exceed the liabilities by about £125,000; and by a reduction of the amount of each share from £20 to £12 10s., the share capital would be brought into accord with the present value of the property. A special meeting is to be held immediately after the ordinary general meeting, to discuss this question. If it should be decided to reduce the capital, the sanction of the Court of Chancery will be required. Notice has been given of an intention to move a resolution to present £1000 to Mr. W. T. Western, the Chairman, out of the Company's funds, in recognition of his valuable services.

Inauguration of a New Storeage Reservoir at Taunton.—A large party of the members and friends of the Taunton Town Council journeyed to Leigh Hill, about five or six miles from the town, last Thursday week, to witness the formal opening of a new storeage reservoir by the Mayor (Mr. Alderman H. J. Van Trump). The water-works were constructed in 1857; but since then, and especially during the last few years, they have been greatly extended and improved. The most important addition, however, is the new storeage reservoir, by means of which a constant, instead of an intermittent, supply will be ensured to the whole of the inhabitants of the town. The extent of the surface of the reservoir, which is situated on a slope of the Blackdown Hills, is 6 acres, and its greatest depth is 38 feet. It has a capacity of 26 million gallons; and it is already quite full. The work was commenced in June, 1891. A dam of great strength has been constructed on the Taunton side of the reservoir, with a slope of one in six. The combined capacity of the two reservoirs is 34 million gallons; and the intake during the summer will average about 300,000 gallons per day. Against this the consumption will be 300,000 gallons per day in the winter, and 400,000 in the summer—averaging 20 gallons per head. Messrs. Bond and Hitchcock, of Taunton, were the contractors; and they have carried out the work in a manner which has given the utmost satisfaction to the Council.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, March 2.

(*Before Mr. Justice* NORTH.)

Attorney-General and Guardians of the Poor of the Wakefield Union v. Morley Corporation and Great Northern Railway Company.

This was an application for an injunction to restrain the Morley Corporation from in any way supplying or selling water to the Great Northern Railway Company for use or consumption in the district of East Ardsley, or for resale to the Rothwell Local Board, and to restrain the Company from receiving or buying water from the Corporation for use or consumption in the district of East Ardsley, or for resale to the Local Board, and to restrain both defendants from carrying the agreement into effect.

Mr. CRIPPS, Q.C. (with him Mr. SWINFEN EADY, Q.C.), in moving for the injunction, said the Wakefield Corporation were the Local Authority supplying water within the district of East Ardsley; and up to December last, the Railway Company had taken their supply from them. In that month, however, an arrangement was made by which the Morley Corporation supplied the Railway Company with water; and the Company in turn supplied the Rothwell Local Board. The plaintiffs alleged that this proceeding was *ultra vires;* and they accordingly asked for an interim injunction to prevent a continuing illegality. Under the Public Health Act, 1875, a local authority could only supply water within its own district.

Justice NORTH: Why should I hear this upon interlocutory motion?

Mr. CRIPPS: For the reason that it is not a question of damages, but is an immediate and continuing injury affecting a Rural Sanitary Authority, for which they will have no remedy unless the Court now interferes. We say that the Morley Corporation and the Railway Company are clearly acting *ultra vires*.

Justice NORTH: That is a point to be decided at the trial of the action.

Sir R. E. WEBSTER, Q.C., M.P., for the Morley Corporation, said his contention would be that he was supplying water within his own district; and great public danger would arise if the injunction were granted.

Mr. CRIPPS said the plaintiffs based their case on two points—first, that, on the defence, there was no real question as to the illegality of what was being done; and, secondly, this being so, that the Court would interfere to prevent a continuing illegality, where the plaintiffs could not be compensated in damages.

Justice NORTH asked why damages could not be awarded at the trial.

Mr. CRIPPS replied that it was not usual to claim damages when the Attorney-General sued on behalf of the ratepayers. The Corporation of Morley supplied water partly under the powers of the Public Health Act, and partly under those of a Special Act of 1890, section 4 of which provided that "the limits of this Act shall be the borough." Ardsley was not within the borough; but the meter had been fixed inside the boundary. It did not make any difference whether the meter was inside or outside, as the water was consumed outside; and the plaintiffs, who had been put to considerable expense in carrying out their obligation, were deprived of a certain amount of revenue. In support of his contention, he cited the case of *The Gaslight and Coke Company v. The South Metropolitan Gas Company.**

Mr. COZENS HARDY, Q.C., who appeared for the Railway Company, pointed out that the Rothwell Local Board had not been made parties to the action.

Mr. CRIPPS said not only were the Railway Company not entitled to take the water, but they could not supply water to other persons. He submitted that, where a public body was prepared to carry out its duty, and there was a *primâ facie* illegality, the Court would grant interim protection. Another element of importance was this: The Company were introducing into Parliament a Bill, in which they were attempting to legalize what the plaintiffs alleged to be an illegality.

Justice NORTH: That is all the more reason why I should not go out of the way now and waste time in deciding a point which will shortly be disposed of by legislation.

Mr. CRIPPS said, with submission, his clients did not think it was likely to be disposed of by legislation. It would be material, before the matter came under the notice of Parliament, that the existing rights of the parties should be ascertained. He was willing for the motion to stand till the trial, if his Lordship would expedite the hearing.

Justice NORTH said he did not consider it a case in which such leave should be given.

After some further discussion, Justice NORTH, in directing the motion to stand till the trial of the action, said: It is clear I cannot now decide the matter, which ought properly to be decided at the trial of the action. No doubt, under particular circumstances, the delay might be such as to cause damage to the plaintiffs which could not be compensated in any way; and I might be driven to anticipate the proper time for trying the legal question, to avoid such injustice. But, in the present case, it seems to me that, assuming the plaintiffs are right, they will be entitled to recover (if they ask for it by their statement of claim) such damages as they have sustained by reason of the defendants continuing to commit an illegal act from the present time till the trial of the action. If the damages are paid to them, they will then have obtained everything they possibly could have if I granted an injunction. Under these circumstances, I should not be justified, considering the merits of the case, in trying the action before the proper time.

On the application of the plaintiffs' Counsel, His LORDSHIP gave leave to amend the claim by asking for damages.

(*Before Mr. Justice* KEKEWICH.)

Halifax Corporation v. Morley Corporation.

This was an action of a similar nature to the one reported above.

Sir HENRY JAMES, Q.C., M.P., Mr. WARMINGTON, Q.C., M.P., and Mr. VERNON SMITH appeared for the plaintiffs. Sir R. E. WEBSTER, Q.C., M.P., Mr. COZENS HARDY, Q.C., and Mr. PARKER represented the defendants.

Sir H. JAMES, in opening the case, said that the plaintiffs' rights depended on the Halifax Gas and Water Act, 1870; and the section mainly in point was the eleventh. Under it, power was given to the plaintiffs to obtain certain additional water; and, among other things, to supply it to the estate of Mr. Henry Saville, to which it was furnished by meter—a minimum and maximum quantity being named.

Justice KEKEWICH interposed, at this point, and asked if this was a case for an interlocutory injunction.

Sir H. JAMES said it seemed to him it was a pure question of law.

Mr. HARDY said there were certain questions of fact which would have to be gone into.

Justice KEKEWICH remarked that he did not see that the plaintiffs could suffer any injury which could not be compensated for in damages when the case came to trial. It was not usual to grant an interlocutory injunction, except to prevent serious injury which could not be remedied by damages.

Sir H. JAMES said his clients were very anxious to bring the matter on—all the more so as it was apprehended that the defendants were attempting to legalize what they were doing by a Bill in Parliament; and the plaintiffs wanted their rights ascertained before they went before the Parliamentary Committee.

Mr. HARDY said he thought his friend was under some misapprehension. There was no Bill being promoted by the Morley Corporation. But there was an arrangement made between the Corporation and the Great Northern Railway Company, who were not parties to this action; and it would be a question whether they ought not to be. He was not in a position to treat this motion as the trial of the action, because he was not sure about certain questions of fact.

Justice KEKEWICH said that he would do everything he could to accelerate the trial of the action. If there were a Bill in Parliament which affected the alleged rights of the parties, it was convenient that those rights should be determined in a Court of Law before, and not after, the Bill went into Committee.

After a little further discussion, it was arranged that no order should be made on the motion, and that, as soon as the pleadings were closed, an application should be made to fix an early day for the trial.

(*Before Mr. Justice* STIRLING.)

Bognor Water-Works Company v. Bognor Local Board.

This matter came before the Court really for a decision as to how the costs ought to be apportioned. The plaintiffs had obtained powers, under an Act passed in 1891, to supply certain districts in Sussex with water, including the town of Bognor. Disputes arose as to the sufficiency of the supply; and the Local Board, on the 20th of May last, served notice on the Company, requiring them to state, within one calendar month, whether or not they could give the town a supply of water proper and sufficient for all reasonable requirements, and, in default of receiving such information, the Local Board would themselves take steps for constructing water-works. They did actually commence boring—with this view, as the Company alleged; but the defendants stated that their efforts were simply directed to ascertaining where it was possible for the Company to obtain an adequate supply. The plaintiffs expressed their willingness to take steps to give a proper supply of water; but a dispute arose as to whether this constituted a really adequate supply. After a long correspondence, the matter was referred to arbitration; and the Arbitrators decided entirely in favour of the Company. Prior to this, the plaintiffs had commenced an action, in which they claimed a perpetual injunction, restraining the Local Board from constructing any water-works within the limits of the district, for the supply of which the Company had obtained statutory powers.* They also asked for an injunction to restrain defendants going on with the arbitration proceedings.

Mr. GRAHAM HASTINGS, Q.C., and Mr. FELLOWES appeared for the plaintiffs; Mr. CHANNELL, Q.C., and Mr. MACMORRAN represented the defendants.

Justice STIRLING held that the plaintiffs were clearly entitled to ask for relief in respect of the first part of the notice of motion; and they ought, therefore, to have the costs of the action. But as, in asking for an injunction to prevent the arbitration, they had raised matters beyond the power of the Court to interfere with, he thought that the costs, so far as they had been increased by this part of the motion, ought to be given to defendants, and that one ought to be set off against the other.

Hydraulic Power and Electric Light Supply.—The annual meeting of the General Hydraulic Power Company, Limited, was held last Wednesday, under the presidency of Mr. H. Chapman. In their report for the past year, the Directors stated that the gross receipts for power were £51,445, as against £46,925 in 1892. After providing for interest on debentures, Directors' and Auditors' fees, and £3600 for depreciation, the available balance was £27,139, including £381 brought forward. The Directors proposed a dividend at the rate of 6 per cent., on account of which an interim dividend of 2½ per cent. was paid in August last; making the distribution for the six months ended Dec. 31, 1893, 3½ per cent. The balance to be carried forward to the next account would be £1141. In moving the adoption of the report, the Chairman said, with regard to the London undertaking, that the number of machines contracted for up to the close of last year was 2025; showing an increase during the year of 177. At Liverpool they were making safe progress; and the prospect for the current year was satisfactory. They had incurred a large expenditure on capital account in connection with the City Road pumping-station and the new mains connecting it with the general system. When that station was completed—and it was hoped that it would be before the end of the year—their pumping capacity would be increased by 40 per cent. With regard to providing the electric light, they had decided in the first place to light up the City Road pumping-station; and he believed they would thus be able to supply the light with advantage to the consumer. The motion was carried.

* See JOURNAL, Vol. L., pp. 296, 337; Vol. LI., pp. 334, 374; and Vol. LIV., pp. 256, 307.

* See JOURNAL, Vol. LXII., p. 1173.

MISCELLANEOUS NEWS.

THE LONDON COUNTY COUNCIL AND THE METROPOLITAN WATER SUPPLY.

A Group of Reports on the Water Question.

In the report of the Water Committee of the London County Council which was presented to that body on the 20th ult., and given in the JOURNAL last week (p. 401), reference is made to certain reports by the Water Engineer (Mr. A. R. Binnie, M.Inst.C.E.), the Parliamentary Agent (Mr. H. L. Cripps), the Medical Officer (Dr. S. F. Murphy), and the Chemist (Mr. W. J. Dibdin, F.I.C., F.C.S.), on the question of the Metropolitan Water Supply. These reports, which discuss the conclusions of the Royal Commissioners and the proposals embodied in the Bills promoted by the Thames Conservancy and the three Water Companies who are about to apply to Parliament for additional powers, have now been issued by the Council in a collected form; and we give below an outline of their contents. They are preceded by the "Memorandum" of the Chairman of the Committee (Mr. A. Bassett Hopkins) which was reproduced in our columns on Nov. 21 last year.

On the 28th of September last, the Engineer was instructed by the Water Committee to prepare a report on the report of the Royal Commission. This he did; and it stands first in the group of the reports now under notice. Mr. Binnie confesses that he approached with much diffidence the "very difficult task" allotted to him; but, having carefully perused the Commissioners' report, the evidence, and the appendices, he does not see any reason to alter the opinions he has expressed in the numerous reports he has placed before the Committee. Mr. Binnie criticizes the method adopted by the Commissioners in taking evidence; the witnesses not being examined at length, but merely questioned upon certain points in their statements to which the Commissioners desired to refer. He also complains of the way in which the Assistant-Commissioner (Mr. R. E. Middleton) conducted his investigations. Having thus indicated the obstacles which presented themselves to him, he proceeds with his report. Beginning with some general remarks, he shows that the areas affected by the inquiry extended over 1442 square miles, over 620 of which the Metropolitan Water Companies have parliamentary powers. He then deals with the statistics of the population and supply, and points out discrepancies in both. Coming to the question of the period over which any future estimate of supply should run, he regards the 40 years' limit fixed by the Commissioners as "one of the greatest blots upon their finding, as it can in no way be considered a final settlement of the case." Mr. Binnie is satisfied with the daily supply per head (35 gallons) fixed by the Commissioners, as this agrees with the decision of the Duke of Richmond's Commission and with his own estimate. Working on the assumption of this quantity per day for a future population of 11¼ millions, the Commissioners arrive at about 415¼ million gallons as the requirements of London in 1931. Mr. Binnie is flattered at the general agreement of the Commissioners with his own figures in this respect; but he regrets that they did not go a step farther, and follow some of them to their logical conclusion. Mr. Binnie then considers the several sources of water; dealing first with the Thames Valley, and next with the pumping and well supplies from the Upper Thames. On the point of the area of the Thames draining to Teddington Weir, the Commissioners are within 23 square miles of the area arrived at by Mr. Binnie's independent measurements; but they accept as correct an area of 3548 square miles draining to the Companies' intakes at Hampton, as compared with 3542½ square miles ascertained by him. As to the possibility of obtaining water from wells in the Upper Thames Valley, Mr. Binnie and the Commissioners are at one in the opinion that little or nothing would be gained to the general supply by these works. The next matter dealt with is the proposal of Messrs. Hunter and Fraser to construct a number of storeage reservoirs in the counties of Middlesex and Buckinghamshire—a scheme to which Mr. Binnie says the Commissioners "accord a general, though not very detailed, approval," but only on the understanding that certain very important suggestions they make are properly carried out. The part of the report dealing with the Thames is discussed at great length; and Mr. Binnie comes to the conclusion that the qualified approval given by the Commissioners to the Hunter-Fraser scheme must be, "not to taking water from the river in its present state, but to an ideal river in the future, out of which, by certain means, Parliament is to keep all injurious pollutions," and the water of which will only be safe to drink after it has been subjected to certain important processes. With a rapidly increasing population of upwards of a million persons, this would, he considers, be a very difficult, if not an impossible task. Mr. Binnie next turns to the other areas in the Thames Valley, between the intakes of the Water Companies, from which it has been suggested that water may be obtained—the Rivers Mole and Wandle. He passes in review the chalk beds under London, and in Essex, east of the Lea, the area of the Kent Water Company, and the district of East Kent. He has been investigating this district for some months; and the result of his observations will form the subject of a separate report. Pending its presentation, he says he thinks the quantity of subterranean chalk water available for the use of London has been over-estimated; while its supply would be attended with much difficulty, and with the risk of drying up the district. The last source dealt with is the River Lea. The Companies claim from this river about 52½ million gallons per day; and the Commissioners think that this, with the provision of additional storeage, might be continued, and pumping carried on to the extent of 40 million gallons from wells, without detriment to the people in the valley. Mr. Binnie considers that the Commissioners, in coming to this conclusion, were somewhat influenced by the copious springs of water said to exist in East Kent; but he fears that any opinion founded on such evidence must be abandoned. He favours the view held by the Duke of Richmond's Commission in 1869, that not more than 50 or 52½ million gallons of water can be taken from the Lea Valley. Mr. Binnie closes his report (of which the foregoing is the merest outline) as follows:—

In attempting, at the present juncture, to sum up and come to a conclusion on the complicated questions dealt with in the report of the Royal Commission, we find that the report cannot be considered by itself, nor without taking into account various other matters, either intimately connected with it or depending upon its opinions, some of which are of such a nature as to demand and require the immediate decision of the Council. In fact, the time has now arrived when the Council must frame for its guidance a definite policy on the question of water supply. The Council has now before it the report of the Royal Commission, the Conservancy Reconstitution Bill, and the applications from the East London, Southwark and Vauxhall, and West Middlesex Companies applying for further powers to construct works or raise money, as well as the Council's own Bill for obtaining power to purchase by agreement certain lands, &c., suited to the purpose of water supply. Reviewing these various subjects from the different aspects in which they present themselves, the first question that claims attention, and which must be answered before any definite policy is adopted, is one of the utmost importance to the vast community represented by the Council. Do the Council desire to become, in the future, the Water Authority for London? This question must be definitely faced, and a reply given in such an exact manner that your officers and witnesses will have no doubt on the subject when representing before Parliament the Council's views.

Reviewing the past attitude of the Council, and the opinions which have been expressed by members of the late and present Administration, I believe it to be the wish of the Council, and it is expected of them by the highest authorities, that they will come forward and assert their rights, as the representatives of the vast population of London, to the control of the water question. Assuming that this be the case, and that the Council is prepared to go thoroughly into the question, then, if success is to attend their efforts, it must be in no half-hearted or faltering spirit that they approach the subject. Should they take upon themselves this most arduous public duty, they must recollect that they will have opposed to them a large and interested body who represent a capital expenditure of some 15 millions sterling. Hitherto the Council has confined itself mainly to pointing out the defects and deficiencies in the administration and control of the water supply of London; but if, in the future, it is to grasp the subject, I apprehend it must be not only with courage, but with determination, at once boldly putting forward the claims of its constituents, and fearlessly admitting all the circumstances and difficulties which surround the question.

A glance at what I have recorded of the decision of the Royal Commission will, I think, carry to most minds the conviction that the decision of the Commission is not a final one, and that, so far as it approves of the continued supply of London from the polluted sources of the Thames and Lea, the decision of the Royal Commission must only be accepted with the almost impossible reservations with which they have surrounded their approval. For the reasons stated, I consider their conclusions with regard to the supply of water from the Lea Valley by means of wells to be impracticable, and their suggestions with regard to East Kent as a future extension of the supply most inadvisable. But the fact that London must continue for ten or fifteen years longer to be supplied from the Thames and Lea is undoubted; for, even supposing some new sources to be determined upon, it would yet require many years before they could be made available. Consequently, we find that the Council must, to a certain extent, and within the reservations proposed by the Royal Commissioners, endeavour, should it be their wish to become the Water Authority, to carry on the supply for such a period as would be necessary for the working out and development of the new system. How then is this important duty to be performed, and the Council placed in the commanding position it should occupy on the water question of London?

The experience of all past parliamentary procedure leads inevitably to the conclusion that in no single instance has Parliament permitted the acquisition by any municipality of the rights of water supply without in the first instance proper arrangements having been made for the purchase of the companies' undertakings upon terms fair and reasonable to both parties. This at once leads to the consideration of the attitude which the Council should adopt in relation to the Bills of the various Companies now before Parliament. Take, for instance, the Southwark and Vauxhall Company. By the evidence given before the Royal Commission by the witnesses of the Council, as noted in the report of the Commissioners themselves, and as acknowledged in the Company's Bill now before Parliament, this Company have exhausted their parliamentary powers both as to the quantity which they are authorized to draw from the Thames, as well as the extent of the works and the amount of money they are entitled to spend. In other words, the Company are applying to Parliament for powers to continue to perform the duties with which they have been invested. Consequently, they cannot claim that at the present moment they are entitled, without the further consent of Parliament, to continue properly to perform their duties and claim future profits. The same may be said of the East London Water-Works Company. They are applying to Parliament because, as pointed out by the Royal Commission, they and the New River Company must no longer be allowed to draw 52½ million gallons a day from the Lea without further reservoir accommodation. This being the case, it is for the Council to consider in what attitude they will approach in Parliament these renewed applications for further powers. Will they acquiesce in these Companies being rehabilitated, and placed for the future upon the firm and solid ground afforded by parliamentary sanction, or will they face the subject, by themselves offering to undertake the duties which those Companies desire to perform in the future?

Mere opposition to the applications of the Companies by the Council must be followed by certain and ignominious defeat; for the whole drift of the evidence placed before the Royal Commissioners by the witnesses for the Council went to show that London requires more water and extended works; and if the Companies are to continue to perform the duties imposed upon them, further powers of some kind must be conferred. The Council can, of course, in its wisdom, decide, if it so pleases, to confine itself to merely watching the Bills in Parlia-

ment, and seeing that proper provisions are inserted as to the non-abstraction of water during periods of flood; as to the maintenance of a sufficient minimum flow over Teddington Weir in periods of drought; and as to proper regulations being enforced for the storeage and filtration of water. But this is merely to give away the very position which, in my humble opinion, the Council must, sooner or later, take up as the Water Authority of the Metropolis.

No doubt the finding of the Royal Commission presents great difficulties in dealing with the question; but when we take into account that their decision, if accepted, is not final, and that the sources from which the future supply, limited to 40 years, dating from 1891, will be derived, are so polluted and far below the standard of excellence generally adopted throughout the country, and also that a very large proportion of the water which they propose to obtain from chalk wells is more or less problematical, I think that the Council would be doing itself injustice were it to accept without reservation such a very limited sphere of action.

There can be no doubt that London can be and ought to be as well supplied with water as any town in the United Kingdom; and I take it to be one of the prime duties of the Council to see that this is the case. Accepting, therefore, the position of the future suppliers of the Metropolis, it behoves the Council to consider whether it will not, in this critical juncture, exert its most powerful efforts to endeavour to make the Conservancy Bill as thoroughly complete as is possible, seeing that London must be dependent upon the Thames and Lea for some years. With that prudence, business capacity, and determination which its members possess, I consider that the time has now arrived when some serious effort should be made by the Council to acquire the undertakings of some of the Water Companies, and to prepare itself to carry on the work now performed by them until it is in a position to afford to the large community which it represents a proper and efficient supply of water. But, as stated at the outset, the first and most imperative duty for the Council is, under the existing circumstances of the case, to settle upon some definite line of action, which can be explained to, and understood by, not only a Committee of Parliament, but likewise the public at large.

Following Mr. Binnie's report is one by the Council's Parliamentary Agent (Mr. H. L. Cripps) upon the report of the Royal Commission and upon the Bills of the Thames Conservancy and the three Water Companies already named. Mr. Cripps deals first with the procedure of the Royal Commission, and then considers successively the conclusions arrived at by the Commissioners, and the question of the future population of the Metropolis, the duration of the Thames supply, and the "40 years period" fixed by the Commissioners. He next points out the necessity for some decision being come to by the Council as to a declaration of policy in regard to the Metropolitan Water Question; and he then goes on to discuss at some length the report and recommendations of the Commissioners. With regard to the Bills, Mr. Cripps first takes that of the Thames Conservancy, with its 300 clauses and schedules, and gives an analysis of it. This is followed by some notes on the Bill, in the course of which he points out that the portion relating to the Water Companies (Part V.) will require most careful consideration. This part of the Bill means, he says, that (1) further rights are to be conferred on the Companies to draw water from the Thames, (2) that the water consumers are to pay additional sums of money which are to go to the Thames Conservancy Board, and (3) that these moneys are to form part of the general income of the Board. He thinks the Bill should be opposed in its present form; and if it ever reaches the Committee stage, he considers it should be amended so as to provide as follows: "(1) That no rights or privileges are granted to the Water Companies with respect to the use of Thames water beyond those which they now possess; (2) that no such rights or privileges should be exercised without the acquiescence of the people of London, expressed through their representative body; (3) that the money now paid, and any additional expenditure desired by the water consumers of London for improving the water which they drink should be devoted exclusively to that object, under the supervision and control, not of the Water Companies or the Navigation Authority, but of the London County Council or some Joint Committee of the Local Authorities of the districts in which Thames water is used for drinking purposes; (4) that any additional expenditure so made should be in the form of a reduction in the Companies' dividends, and not in the form of a contribution towards the maintenance or increase of those dividends; and (5) that nothing done under the Act, and no expenditure under the Act, should give the Water Companies any additional claim for compensation over and above that which they now possess."

Mr. Cripps's report is followed by a note by Mr. Binnie, in the course of which he says: "Looking at the Bill as a whole, it strikes me that, whatever the constitution of the new Conservancy Board may be, whatever the duties they undertake, and whatever the area over which their jurisdiction may extend, the Bill itself leaves practically untouched the very vital defect, as pointed out by the recent Royal Commissioners, that the revenue will be too small to enable the duties to be properly carried out; and as a large part of the revenue which will come to them will be derived directly from the Water Companies, it will leave the Conservators in the future, as in the past, so dependent upon the good-will of the Companies as to place them in a position of subjection which should not be occupied by so important a body. In other words, as far as I understand the Bill, there are no means of raising the necessary funds for carrying on what will prove to be a large increase of work for the new body, except the additional sum of about £12,000 to be received from the Metropolitan Water Companies, and which sum is in no way allocated to the new duties. In 1891 the Thames Conservators' total income for both upper and lower navigation amounted to about £108,000, of which the Water Companies contributed about £18,000. It will be for the Council to consider what rating powers (if any) should be conferred upon the Conservators, and, if rating powers be conferred, what representation the districts rated should have upon the new Board." Mr. Binnie deals with the various clauses relating to works; and with respect to the control of the Upper Thames, he expresses the opinion that, in view of the many disputes which have arisen as to matters of fact in regard to the quantity of water flowing down the river, it should be made obligatory on the Conservators "to construct and in the future to maintain, for the use of all persons interested, proper and exact measuring apparatus at at least three critical points on the river—viz., at Teddington, at Staines, and at some point near Oxford." He thinks also that the Council should have the right of entry into the works of the Water Companies. He closes his note by giving two tables showing the income of the Board arising from contributions by the Companies, and the quantity of water taken by them.

Mr. Cripps follows with a note on the East London Water Bill; and Mr. Binnie adds some comments on the engineering features of the measure. He explains that the works for which the Company seek powers become necessary in consequence of the expression of opinion by the Royal Commission with regard to the total quantity of water claimed from the Lea by the East London and New River Companies. He thinks, with regard to the Lea, that the Council might endeavour to obtain the sanction of Parliament to the fixing of a certain minimum quantity of water which shall not be reduced, under any circumstances, either by the Water Companies or by the Lea Conservancy Board. He regards the present as a favourable time for the Council to take some steps to prevent the pollution of the Lea Valley, to extend the powers of the Official Water Examiner so as to include right of entry into all water-works, and the adoption of some general regulations that all water supplied by the Metropolitan Companies shall be on the constant service, and uniformly delivered at such a pressure as to reach a height of 75 feet above the street level, and no extra charge made for such supply. This he believes will be found to accord with the practice generally adopted in the large municipal towns.

The Southwark and Vauxhall Water Bill is next dealt with—first by Mr. Cripps, and afterwards by Mr. Binnie. The latter gives special attention to the proposal of the Company to take water from the Thames at Teddington Weir, provided the flow is not reduced below 200 million gallons per day by the total quantity abstracted by themselves and the other Water Companies. He produces a table giving the average daily discharge of the river at this point in certain dry months, and another showing the extreme minimum flow per 24 hours on certain days during the past nine years. In the former, the average ranges from 282·1 million gallons in August, 1884, to 188·8 million gallons in September, 1893; in the latter, from 212·9 million gallons on Aug. 25, 1884, to 141·3 million gallons on Aug. 21, 1893. Mr. Binnie observes on this point that, "seeing that the average minimum discharge of the Thames, after abstraction of the water by the Water Companies, fell, during the months of July, August, and September last, to a little under 250 million gallons a day, it would not, I think, be exceeding the contemplated improvement of the Royal Commissioners if we place the minimum at 300 million gallons per day." As to the works projected by the Company, Mr. Binnie says that, inasmuch as they "do not propose to carry out what was practically their own suggestion before the Royal Commission—viz., to draw water from the Thames at Staines, 18 miles above Teddington Weir—it becomes a question how far they are entitled to claim from Parliament a renewal of their exhausted powers as regards the abstraction of water, the construction of works, and the raising of new capital."

The West Middlesex Bill, being a Money Bill, is shortly noticed by Mr. Cripps only; and he then discusses at considerable length the whole financial question. He closes his report as follows: "If the Council take the question generally into consideration, they must deal with the course to be adopted as regards either the Water Companies together, or at least the three Companies who have now Bills in Parliament. The Council have materials before them which will enable them to judge whether any steps should be taken, and, if so, of what character, either to secure the right of providing an independent supply, with or without compensation to existing interests, or of purchasing, and, if so, on what terms, the existing undertakings, or any of them. It may be undesirable for me to deal with this matter in a report of this character; but I would observe that the Council may, as a matter of procedure, if they think it would be expedient, propose the insertion of clauses in these Bills, as a condition of their being allowed to pass, to the effect that the Council should be entitled to purchase the Companies' undertakings on terms to be defined, or according to a system and on principles to be defined; but this could only be applicable to the undertakings of the three Companies who now have Bills in Parliament. I suggest, therefore (subject to any general resolution which may be arrived at by the Council on the more important point hereinbefore referred to), that clauses should be proposed: (I.) Empowering the Council to provide the capital required for new works. (II.) That the whole of the dividend attributable to the capital so invested should be applied (1) in providing the interest upon and for the redemption of the stock issued by the Council to raise the money required for the investment, or (if the money be provided out of the loans fund), in making provision for its replacement with interest in the loans fund at the proper period; (2) that the surplus profits, after making these provisions, should be invested to form a fund; (3) that this fund should be utilized for keeping up the interest and provision for the sinking fund in respect of the money advanced, in case the dividend earned in any year should be insufficient, and, subject thereto, in forming a fund for the ultimate acquisition of the Company's undertaking, or for such other purposes as Parliament may define. It may be that the Council will consider, having regard to all the circumstances of the case, that expenditure on the works now proposed would be undesirable; and, of course, should they adopt this view, the Bills would be opposed entirely." Mr. Cripps offers a few remarks on the Colne Valley and Swindon Water Bills, and the East Surrey and Tilehurst District Water Orders; and Mr. Binnie adds a note on the last-named Order.

The two remaining reports—those of the Medical Officer and the Chemist—can only be briefly noticed. Dr. Shirley Murphy's instructions were to discuss the report of the Royal Commission; and, in carrying them out, he limits his observations to that portion of the report which relates to the quality of the present sources of supply. He quotes from the report the circumstances which contribute to the safety of the London water consumer, and then plunges into the

question. His work is divided into several sections, dealing with the dilution of polluting matter, the viability of the typhoid bacillus, storeage and filtration, the evidence of experience, and the definition of efficient filtration. Dr. Murphy's conclusions are as follows: "In view of the changes effected in the rivers, and subsequently in the filters, the risk to Londoners is, I believe, small and certainly intermittent, and indeed may be thought of as comparable to those possibilities of injury from accident in the street to which every human being is subject during the whole of his life. The risk, indeed, is to each a possibility, and not a probability; but such as it is, I believe it exists. If we recognize, as I believe we may, that the safety of London residents is dependent upon the efficiency with which deleterious matter in the London rivers is, by artificial means, removed from the water supplied to the Metropolis, the conditions under which this removal is to be continuously ensured must obviously be determined with absolute precision; and an administration must be provided to secure that the object in view shall be attained." Mr. Dibdin, in a short report, reviews the conclusions of the Commissioners on the subject of the quality of the London Water Supply. He considers that, notwithstanding their defence of the water, mainly on bacteriological lines, the contention of the Council's witnesses as to its frequently inferior quality and the urgent necessity for its more systematic examination, has been well sustained by an unhesitating verdict in their favour.

The Proposed Purchase of the Water Companies' Undertakings.

At the Meeting of the London County Council last Tuesday—Mr. J. HUTTON in the chair—the report of the Water Committee, presented at the previous meeting (see *ante*, p. 401), came up for discussion.

Mr. A. BASSETT HOPKINS, in moving the adoption of the report, stated that it and its recommendations were regarded by the Water Committee as the first step towards the attainment of what had been described as the municipalization of the water supply of the Metropolis. The Committee would have liked to be able to formulate a more detailed scheme on the subject; but, in view of the construction put by the Water Companies on the findings of the Royal Commission, some action was necessary at once. The Commission had found that it was possible to obtain, without going outside the Metropolitan area, a quantity of water sufficient to satisfy the needs of the Metropolis for a period reaching to 1931. The Companies had drawn from this the conclusion that, because it was physically possible to get such a supply, it ought to be done. But no conclusion was less justifiable. The Commission had been extremely guarded on the question of policy. The Companies, however, having put this interpretation upon the report, three formidable Bills had been promoted by three of them; and if they obtained the powers applied for without proper safeguards, it would be nothing less than a calamity to Londoners. Two of the Companies asked for authority to construct works of huge magnitude and great permanence; while the Southwark and Vauxhall Company had had the boldness—he might use even a stronger phrase—to ask, in the name of the united Companies, for power to take from the Thames the whole of the water running down to Teddington, with the exception of 200 million gallons a day. He did not believe Parliament would grant anything like such powers, which would be disastrous to the hopes of the people of London. Immediate action was necessary, because these Bills would soon be before Parliament. If the Council could show that they were willing and able to undertake, upon fair and just terms, and to carry on, the water supply of the Metropolis, all pretext for addition to the vested interests of the Water Companies would be removed. The Commission found that 415 million gallons of water per day would be required in the year 1931. In order to provide this supply within the Metropolitan area, works would be necessary that would cost £10,000,000 in round figures on the estimate of the Companies, and double this sum on the estimate of the Council's Engineer. In addition to storeage reservoirs, there must be works to prevent pollution and to improve filtration. But, even if these works could be executed, why should London adopt a lower standard of life than other large cities? Manchester, Birmingham, and Glasgow had abandoned the idea of a supply from a river running through highly-cultivated districts. It was time that something should be done to put an end to the system under which the Metropolis was supplied with water solely by Companies which had been established for their own profit. The County Council were willing to deal with the Companies in an equitable spirit, and to take over their undertakings on fair and just terms; and the Committee proposed that they should invite the Companies to a consultation with them on the matter. If the Companies refused to agree to this proposal, and to meet the Committee in an amicable spirit, the Council would be asked to go to Parliament, in order to obtain from that tribunal the basis of a just and equitable arrangement on which the transaction should ultimately proceed. What the Council were asked to do that day was to sanction what would be the first of a series of events which the Committee trusted would lead to the realization of the hopes of their predecessors, and of what had been declared to be the only sound policy by three Royal Commissions—viz., the transfer of the control of the water supply of London, which was one of the first necessaries of life, from the hands of the existing Companies to those of the representatives of the Metropolitan population.

Mr. W. SAUNDERS, M.P., remarked upon the charges made by the Companies, which, he said, were much higher than those in other cities. While willing to recognize vested rights, where these existed, he reminded the Council that they were entitled to provide a water supply for the Metropolis. He therefore moved the addition to the Committee's recommendation of words providing "that no monopoly right on the part of the Water Companies be recognized."

Mr. HARVEY seconded the amendment.

After some remarks by Mr. Torr in support of the amendment, it was accepted.

Colonel ROTTON inquired if the Companies were not legally protected by their statutes against competition.

Mr. BASSETT HOPKINS said the Companies had no statutory monopoly whatever; and there was nothing, so far as the law was concerned, to prevent the County Council having a competing supply.

Lord FARRER said he did not oppose the report; but he doubted whether it was a favourable time for treating with the Companies, because the latter had just had the report of the Royal Commission, which appeared, on the face of it, to be very much in their favour. The Companies were at present flushed with success; and until that report had been pulled to pieces by criticism, he did not think the public could be quite aware of what its meaning really was. There were reasons why the Council should approach the Companies on terms of agreement; but personally he did not expect any immediate result from the attempts at negotiation. He suspected that those attempts would fail. He believed the Council had a long and a very difficult contest before them; and his object in rising was to indicate certain precautions which he should like to see taken, because he thought they ought to go into this contest with as many allies as possible, and should foresee and guard against some of the very great difficulties which experience had shown they would have in their way. On a former occasion, when they had a parliamentary contest with the Companies, they were in alliance with the Corporation of the City of London; and very powerful and useful allies they were. It would not be quite so easy, perhaps, to get the City as an ally now. It was, however, obvious that the Corporation were quite alive to the necessity of taking steps to preserve their popularity. With that view, they had done many useful things; and he would not despair of getting them to join in this contest. The Council must also endeavour to make an alliance with those parts of the water area of London that lay outside their own area. These districts greatly desired to have the management of their own water supply, and rejected almost unanimously a proposal that there should be a joint Water Authority, on which they should be represented. An attempt should be made at once to enter into communication with the authorities of these districts, and to endeavour to act in concert with them in dealing with the Water Companies. The Council should also seriously consider the relation in which they were going to stand towards the districts in the valley of the Thames. The Commission had told them that they would require most stringent measures for the purification not only of the Thames, but also of all its tributaries. They would not merely require that, but an army of inspectors; and if they went into every house and garden on the banks of the tributaries of the river, there would be a rebellion. These people would say it was true that the Commission reported that there ought to be more efficient means of purifying the water; but it also said that the water was now as pure as it could be. At present the suggestion was that the Companies should pay for this inspection; and this meant that the consumers should pay for it, in order that the County Council might buy up the undertakings at the consequently increased value. It was very desirable that they should meet these difficulties fully, before they entered upon a parliamentary contest. His opinion was that, if they interfered to purify the streams in the way the Commission desired, the scheme would prove impracticable in the end, and would break down, with the result that London would be driven to some other source of supply.

Mr. LLOYD denied that the report of the Commission was favourable to the Companies. It showed that the Thames could not be kept pure except at great expense, and that the supply would only be adequate for a certain number of years. The Council's duty was to approach the Companies on fair terms of purchase.

Dr. COLLINS and Mr. WESTACOTT continued the discussion, and supported the Committee.

Sir J. LUBBOCK said he was one of the minority who were of opinion that this was not the time for the Council to approach the Companies in the manner recommended by the Committee. Moreover, he thought that it was undesirable for the Council to burden themselves with the enormous addition that would be made to their labours by taking over the water-works; and that, if they were to do this, they would not thereby save the pockets of the ratepayers, as it would be found that the supply would cost more under the Council's management, and, instead of reducing, would raise the rates.

Major PROBYN said he could not agree with either Lord Farrer or Sir J. Lubbock; and he hoped the report would be unanimously adopted. In the course of his remarks, he stated that the River Thames above Teddington, from which the water supply was largely drawn, was contaminated by the sewage of a million people. His Lordship had endeavoured to influence the Council in the matter of the purity of the existing supply; but he (Major Probyn) regarded it as highly objectionable that the people of London should have to drink diluted sewage.

The amendment was then agreed to; and the report of the Committee, as amended, was accepted.

On the motion of Lord MONKSWELL, it was resolved that the Committee should communicate with various authorities that would be affected, and ascertain their views on the subject generally

Reduction in the Price of Gas at Spalding.—The Gas Committee of the Spalding Improvement Commissioners have resolved to reduce the price of gas 3d. per 1000 cubic feet, bringing it down to 3s. 3d., and also to lower the lighting rate from 4d. to 3d. in the pound. The penny-in-the-slot meter system has been adopted by the Committee; and a considerable number have already been fixed.

The New Water-Works for Malvern.—The water scheme, for which the Malvern Local Board obtained Parliamentary powers in 1891, is now approaching completion; and the opening ceremony will take place in May or June. The question of the water supply of the town has been a troublesome one to the Local Authority for more than a quarter of a century; but it is believed that the difficulty has been solved by the present scheme. The reservoir is situate at the British Camp, and has a capacity of 40 million gallons. The water will be collected on the hills, and taken by means of catch-water drains to the reservoir, from which it will flow to the town by gravitation. Two filter-beds have also been provided, capable of passing 200,000 gallons in twelve hours. The work has been executed by Mr. A. Gall, of Alloa, under the supervision of the Engineer (Mr. Copland). The amount of the contract was a little above £34,000; and the extras will, it is thought, be under £2000. The cost of land, parliamentary expenses, &c., will bring the total outlay to between £45,000 and £46,000.

PROVINCIAL GAS AND WATER COMPANIES.

The results of the working of the various Provincial Gas and Water Companies whose reports were received last week are noticed in the following paragraphs.

Gas Companies.

The ordinary half-yearly meeting of the Accrington Gas and Water Company was held at the offices on the 26th ult.—Mr. S. Longworth, J.P. (the Chairman) presiding. The Directors' report showed an expenditure on capital account of £1000 for two purifiers, £950 for land purchased at the old Oakenshaw Gas-Works, £432 on new mains, £35 for additional service-pipes, and £398 for new meters. Despite commercial depression and short time in the cotton trade, the quantity of gas sold was about the same as in the corresponding half of the previous year. The receipts for residual products were satisfactory, save on the tar account, which showed a decrease of £527, consequent on the low prices ruling. The total receipts were £29,286, of which £9103 was profit; and the Directors recommended dividends at the rates of 10 and 8 per cent. The report was adopted.

The ordinary general meeting of the Ascot District Gas Company was held at the London offices on Monday last week—Mr. Robert Berridge in the chair. The accounts presented showed a profit of £772 on the past year's working. This, with the balance brought forward, enabled the Directors to write £500 off the preliminary expenses, and show a balance of £890, out of which they recommended a dividend at the rate of 2½ per cent. per annum, less income-tax. The Directors reported that the business of the Company was progressing in a satisfactory manner, and that the works and plant were in good order. The Chairman, in moving the adoption of the report, said it would be seen therefrom that the Company were making satisfactory headway; and, as building was still going on, there was no reason to doubt that they would be in a better position at the close of the current half year. Mr. Spencer seconded the motion, and asked if they were really making much building progress at Ascot. The Chairman replied that the place was extending very rapidly; and the Company had had an application for putting on 100 new lights. Much gratification was expressed at the writing off of the £500. The report was adopted. Messrs. Welton and Bridger were re-elected Auditors; and a vote of thanks was accorded to the Board and to the employees for their services.

It was reported at the annual meeting of the Canterbury Gas and Water Company yesterday week that during the past year there had been a small increase in the consumption of gas. The extension of the carbonizing plant referred to in last year's report had been completed; and the Directors had now under consideration further alterations and improvements in the manufacturing plant, which they trusted would be conducive to efficiency and economy. The Company, in common with other gas undertakings, felt serious inconvenience through the late strike; and it was only by the greatest exertions that sufficient coal was provided to keep up the daily supply of gas. With regard to the water undertaking, the number of consumers had steadily increased; and a further extension of the mains in the village of Sturry had been made. Having carefully considered the present position of the Company's affairs, the Directors stated that they felt warranted in reducing the price of gas to the consumers, and giving to the shareholders an increase in the rate of dividend. From Jan. 1 last, the price of gas would therefore be reduced from 3s. to 2s. 10d. per 1000 cubic feet. The amount standing to the credit of the dividend account, after providing for the interest on the mortgage loans, was £5559, which sum included the additional dividend of 1 per cent. on the gas capital, due to the shareholders this year under the operation of the sliding-scale; and the Directors recommended that a uniform dividend at the rate of 4½ per cent. be declared on both the gas and water stocks—making, with the interim dividend, 8½ per cent. for the year.

The annual meeting of the Chelmsford Gas Company was held on the 24th ult. The Directors reported that they had found it necessary to erect further new retorts upon a modern principle. These had been recently completed, at a cost of about £650; making, with the ordinary expense of repairs and maintenance of works and plant, an expenditure of £1139, as against £498 in the previous year. The gross revenue for the twelve months, it was stated, showed an increase of £340. The Directors recommended the payment of dividends at the rate of 7 per cent. on the original share capital and £4 18s. per cent. on the additional capital, free of income-tax. In moving the adoption of the report, the Chairman (Mr. W. W. Duffield) remarked on the advantages which would accrue to the Company from the improvements which had been effected. They had, he said, limited their dividends to such an extent as to make their future dividends secure. Touching on competition, he observed that they could not shut their eyes to the fact that the electric light was a great competitor. Although there prevailed the opinion that the antagonism between the Company and the Electric Lighting Company was of an unpleasant and disagreeable character, he could say that they had never hesitated to admit that anything which was an improvement in the matter of lighting, people were within their right in adopting. The only thing the Gas Company desired was that this subject should be dealt with in good faith, and without the small amount of friction that existed in the borough. The report was passed.

The half-yearly meeting of the Chesterfield Gas Company was held last Wednesday, under the chairmanship of Mr. R. T. Gratton. In the report which was presented, it was mentioned that the net profit for the six months was £3376; being £402 less than the corresponding period of last year. The business and profit were affected very prejudicially by the dispute in the coal trade. The increased expenses in the manufacture of gas amounted to £349; and the exceptional drought caused an additional expenditure amounting to £165. The dividends now recommended on the ordinary capital, together with the dividend in August, would amount to 5½ per cent. for the entire year; and the sum required to pay them had been earned, with a trifling exception. The Chairman, in moving the adoption of the report, touched upon the coal crisis and the drought. Alluding to the attack made upon the Engineer and Manager (Mr. C. E. Jones), at the "Wharncliffe" meeting held to consider the Bill now before Parliament, he spoke in highly complimentary terms of the foresight and sagacity shown by him in obtaining coal sufficient to last the Company through the strike. During the drought, his duties had been anything but pleasant; he was persistently asked for what he had not got. If they obtained the powers to carry out the new scheme, there would be no complaints in future as to the scarcity of water. He would have been glad if the scheme could have been carried out at less cost. The rates, which appeared to be high, had had to be inserted in order to ensure a return for the money invested in the works. As to the opposition the Bill was meeting with, he was not surprised nor alarmed by it. The report was adopted.

In commenting upon the Directors' annual report at last Wednesday's meeting of the Derby Gas Company, the Chairman (Mr. Swingler, J.P.) stated that there had been a decrease in the consumption of gas during the past year of about 10 million cubic feet, or equal to 2¼ per cent.; but there was an increase in meter-rentals. In 1892 the public lamps of the town consumed 40 million cubic feet of gas; while in 1893 the figure was 40,750,000 cubic feet. One of the great difficulties during the past year had been the question of coal. It was this which had caused the Directors to increase the price of gas; and he knew that the Company had brought down upon themselves a considerable amount of odium in consequence. But the extra amount they had to pay for coal during the strike was £4000; and they were thus compelled to raise the price of gas. He was afraid that, when the Company had to enter into coal contracts again, they would have to pay a considerable increase over and above the price ruling at present. This was due to the fact that the coalowners were forming a combination for the purpose, as they said, of taking a greater share of the fatness which, it was alleged, went to gas and railway companies. The net result of the year's working gave them a balance of £8839 to pay the maximum dividend. This would absorb £9125; so that a balance of £726 would have to be drawn from the reserve fund. This would leave the reserve fund at £8076, which was a very low sum for a Company of their capacity, and with a capital of above £300,000. In 1889 the fund stood at £20,114; but since then it had been going down. The report was adopted; and the usual dividends of 10, 7, and 5 per cent. were declared.

A satisfactory report was submitted at the meeting of the Douglas Gaslight Company on Monday last week. It showed that the net profit for the half year ending Dec. 31 last was £3469, which was a slight improvement over the corresponding period of 1892, notwithstanding the increased price paid for coal in consequence of the miners' strike. This, however, was largely counterbalanced by the better return from residuals, especially sulphate of ammonia. To meet the cost of the new purifiers recently erected, and to provide for a new set of condensers, the Directors recommended an increase of one-tenth in the capital. Including the balance brought forward from the previous year, there was available £4390, out of which it was proposed to pay a dividend of 35s. per share. The report was adopted.

In the report which the Directors of the Dover Gas Company presented to the proprietors at their half-yearly general meeting yesterday, they stated that although, during the greater part of the latter half of the year, they were shut out from the source of one-third of their usual coal supply, in consequence of the miners' strike in the Midlands, they had passed through the crisis with very trifling extra expense. They also reported not only an increase in the consumption of gas, but a substantial rise in the value of some of the residual products; and the coal supply for the current half year had been secured (should nothing unforeseen occur) at the prices ruling before the strike commenced. These circumstances enabled them to make a reduction of 3d. per 1000 cubic feet in the price of gas, commencing on the 1st of January last, in addition to the reduction of like amount made in July last. The Directors stated that it seemed probable that during the year a supply of electric light would be introduced into a part of the town. But, having regard to the results of similar works in other places, and to the increasing use of gas for heating and cooking purposes, they did not anticipate that the prosperity of the Company would be thereby affected. The accounts accompanying the report showed receipts to the amount of £16,525, and expenses to the extent of £12,949; leaving a balance of £3576. The Directors recommended a dividend at the rate of 7½ per cent. per annum, less income-tax.

At the recent annual general meeting of the Elland-cum-Greetland Gas Company, the Chairman (Mr. J. Dodgson), in moving the adoption of the report, an epitome of which was given in the JOURNAL for the 20th ult., stated that the income from the sale of gas showed a slight falling off—amounting to £59. This, with the natural increase of 4 per cent., which was expected (and for which they had to prepare, this having been the rate in late years), showed a loss of £440 of income for the past year. This was chiefly due, first, to the slackness of trade, short time having characterized several businesses; secondly, to those sometimes disastrous things, the destruction of business premises by fire, of which some of their customers had had a taste; thirdly, to the exceptionally fine weather; and, fourthly, to the "fog strike." The income from the residual products was more encouraging—showing an increase of £525. At the commencement of the past year, tar and ammonia were at their lowest ebb; but during the last six months, they had considerably increased in value. It followed that the income from this source would be enhanced during the present twelve months. The report was adopted. Mr. Gaukroger proposed a vote of thanks to the Manager (Mr. R. Porter) and the staff. He remarked that the works had been most ably managed; and their thanks were especially due to Mr. Porter, not only for the manner in which he had carried out the extensive alterations, but for the way he had steered the concern through the disastrous coal strike, without the gas supply failing. Mr. J. Wilson, on behalf of the Directors, supported the motion, which was heartily endorsed by the meeting. A vote of thanks to the Chairman concluded the proceedings.

At last Tuesday's meeting of the Gloucester Gas Company, the Directors had to report that the quantity of gas sold during the half year ending Dec. 31 last, compared with the corresponding period of 1892, showed a slight diminution; but that the amount of gas-rental had increased through the alteration made in the price in 1892. The revenue from coke was much larger, owing to the higher prices

obtained during the recent coal strike; and the receipts from sulphate of ammonia had considerably improved. The expenditure for coal had greatly decreased; contracts having been made at much reduced prices. During the half year the number of cooking-stoves let out on hire increased satisfactorily. The following figures are taken from the revenue account which accompanied the report (those in parentheses being for the corresponding six months of 1892): The income from gas amounted to £13,939 (£12,852); from meter-rents, to £351 (£344); from cooking-stove rents, to £107 (£89); from coke, to £2811 (£1845); from tar, to £331 (£367); from sulphate of ammonia and ammoniacal liquor, to £876 (£675); from breeze, to £49 (£48); and two or three other small items brought up the total receipts to £18,501, as compared with £16,238. The manufacturing expenses came to £9690 (£10,831), of which £6910 (£8471) was spent on coal; distribution cost £518 (£530); lighting and repairing public lamps, £330 (£320); rents, rates, and taxes, £434 (£438); management, £832 (£834); discounts, £669 (£631); and bad debts and law charges made the total £12,502 (£13,635). The balance carried to profit and loss account was £5999, as compared with £2603. The net profit for the half year, after providing for interest on mortgages, &c., was £5538, out of which the usual dividends were declared. These required £3928, leaving £1610 to be carried forward.

The Directors of the Harrow District Gas Company report that the past half year has, by reason of the coal strike, been one of considerable anxiety to them; but the high price of coal has been somewhat mitigated by the better value obtained for the residual products. The revenue for the six months amounted to £5238; and the expenditure, to £3598—leaving a profit of £1640. The balance of profit and loss account is £1711. At the meeting of the shareholders yesterday, dividends were declared at the rates per annum of 7½ per cent. on the original "A" capital, 7 per cent. on the first additional "B" capital, and 5½ per cent. on the second additional "C" capital, all less income-tax. A resolution was also passed, approving of the Bill empowering the acquisition of the property of the Great Stanmore Gas Company.

The result of the working of the Kingston Gas Company during the half year ending Dec. 31 last was satisfactory, which (the Directors remark in their report) was scarcely to be expected, considering the exceptionally mild and bright weather. The net profit of the half year was £7550; and from this the maximum dividends are to be paid.

At the recent annual general meeting of the Longwood Gas Company, the Chairman (Mr. E. Armitage), in moving the adoption of the report, stated that during the past year there had been some serious drawbacks. The first was the coal strike. This had caused a great amount of anxiety to the Directors, and had also entailed additional expense. The second was the general depression of trade, together with exceptionally mild and open weather, unaccompanied by any prevalence of fogs. These causes had militated to a considerable extent against the sale of gas. In spite of the strike, the amount paid for coals had been less than in the previous year. The wages had also been lower; and although the bulk of coal carbonized was less, the revenue from coke had been considerably more. The gas consumed for the public lighting showed an increase over the preceding year. The report was adopted. A vote of thanks having been accorded to the Chairman and Directors, the Chairman, in acknowledging it, said he had omitted, in his opening remarks, to mention that 72 new services had been laid on during the year, and the gas unaccounted for had been reduced by 2 million cubic feet. This, he felt sure, spoke well for the management of the works. He was pleased to state that he had never paid a visit to the works without finding Mr. Mitton (the Manager) at his post; and, in his opinion, the success of the Company was due to the skill, ability, and attention which he bestowed upon his duties. The meeting then terminated.

The annual meeting of the Matlock and District Gas Company, Limited, was held last Thursday week. The report showed that, after the payment of debenture interest and the interim dividend, there was a balance of £1283 available for dividend; and after writing off £415 for expenses in obtaining the new Act, this was reduced to £892. It was decided to pay from this a dividend of 5 per cent., less income-tax for the past half year. Notwithstanding that the miners' strike affected the price of coal, the Directors reported a gain of £195—the profits aggregating £2162.

The half-yearly general meeting of the Ossett Gas Company was held on the 22nd ult.—Mr. J. Ward presiding, in the absence of the Chairman (Mr. W. Statter). The report and financial statement for the six months ending December last showed that the share capital, fully paid, stood at £43,000. From the revenue account it appeared that the expenditure for the manufacture of gas was £247 more than in the corresponding period of 1892. The sale of gas to ordinary consumers produced £82 more; and, for public lighting, £142 more. The residual products yielded £257 more. A sum of £1730 was required to pay the full dividend; and the balance of profit shown was only £1711. To make up the difference, £19 was taken from the reserve fund, which was then left at £2654. The report was adopted; and dividends at the rates of 10 and 7 per cent. per annum were declared for the half year. The retiring Directors and Auditor having been re-elected, the Chairman, in answer to a question, stated that during the past six months £515 more had been paid for coal; but £260 more had been received from the sale of coke, and £230 more from the sale of gas. The gas sold showed an increase of 321,600 cubic feet. There had been only two months with gas at the increased price; and the effect of the advance would be greater for the current half year. A shareholder referred to the impending dispute with the Corporation of Ossett and the Horbury Local Board, which was mentioned in the JOURNAL last week (p. 404); and he asked if the Directors were charging the Local Authorities more than was charged in other districts. The Chairman said he did not know that they were. He believed there were complaints as to the quality and the price of gas; and it was urged that it was desirable to abolish meter-rents. Looking at the number of meters, and at the cost of them, as well as the £180 which was realized by the meter-rents, he did not see how the latter could be abolished. A vote of thanks having been accorded to the officials, the Secretary (Mr. J. Castle) and the Manager (Mr. W. Moys) briefly responded. The latter, alluding to the loss of gas by leakage, said that during the past two years they had had no end of trouble with escapes. In the previous week he had no less than seven in three days. In two days they lost about 200,000 cubic feet of gas—this quantity going out in excess of the amount for any other two days in the previous week. This large escape took place from a main; and it was caused by a boiler falling off a waggon. In another place, a settlement occurred after a drainage excavation, and a 3-inch main was broken in two. The leakage in the past half year was 16 per cent., or 2 or 3 per cent. more than for the corresponding half of last year. The leakage usually ran at about 12½ per cent. In one part of the town, they had had as many as four leakages a day to deal with, owing to colliery subsidences. The proceedings then closed.

Presiding at the half-yearly meeting of the Salisbury Gas Company, the Chairman (Mr. G. Fullford) congratulated the shareholders on an increase of business; but that feeling of satisfaction was, he said, considerably alloyed by the troubles that had obtained during the period in question, with regard to the supply of coal. At the outset of that difficulty, many gas companies took measures for protecting themselves by raising the price of gas; but, in their own case, the Directors, though well knowing that they would have a large advance in the coal bill to deal with, decided to endeavour to tide it over, looking to their increasing trade as a means of recouping themselves in time. So far it appeared they had acted rightly. The actual increase in the cost of coal, after allowing for the additional make of gas, was close on £1000 as compared with the corresponding period of 1892. On the other side, however, they had received some help from residuals. Not only had they been able to get a higher price for coke, but tar and sulphate of ammonia had realized better values, and altogether they had an increase of £415 under that head. The receipts for gas had been augmented by £212. In some other respects their expenditure had been less; and the ultimate result was a profit of £932, or £178 less than the sum required for dividend. They proposed, however, to pay the usual rates; and with regard to the deficit, they had the reserve fund to fall back upon if necessary, but would wait to see how the year's working turned out before resorting to that. There was reason to hope that things would be better during the current six months. He should not be doing right if he did not allude to the special strain that had been thrown upon Mr. Hardick, Mr. Humphrys, and other members of their staff during the winter. Not only had the price of coal been high, but the delivery was very uncertain and the quality most indifferent at times. He moved the adoption of the report, and the declaration of dividends at the rates of 10, 8, 7, 6, and 5 per cent. per annum on the various classes of shares. This was agreed to. Before the proceedings terminated, Mr. Humphrys, at the request of the Chairman, gave a few particulars regarding the new gasholder tank which is in course of construction. It is to be 105 feet in diameter and 25 feet deep; and when filled with water will represent a weight of about 3000 tons.

At the recent half-yearly meeting of the Sevenoaks Gas Company, it was reported that the gross receipts amounted to £5724; and the gross expenditure, to £3624—leaving a profit of £2099. This amount, added to the balance brought forward, gave an available sum for dividend of £3004; and the Directors recommended the usual payment at the rate of 10 per cent. per annum on the original capital, and 7 per cent. per annum on the additional capital. The report was adopted.

The annual meeting of the South Shields Gas Company was held last Wednesday. The Chairman (Mr. R. Wallis) submitted the Directors' report, which showed that on the year's working there was a net profit of £19,473—the total receipts having amounted to £58,352; and the expenditure, to £38,879. After adding to this the balance brought forward, and deducting the interim dividend of 4½ per cent., and the year's interest, reaching together £9761, there remained an available balance of £9781, which it was proposed to apportion as follows: To the half-year's dividend at 4¾ per cent., £7396; in part payment of arrears of dividend at ¼ per cent., £389 (making, with the statutory dividend of 9¼ per cent., 9½ per cent. for the year); in reduction of suspense account, £648; to the credit of the insurance fund, £500—leaving £847 to be carried forward. The receipts from residuals, the Directors stated, had been satisfactory—sulphate of ammonia giving an increased profit of £906, and coke and tar yielding a similar amount to the previous year. There had, however, been a slight decrease in the sale of gas. During the year larger mains had been laid, with a view to augment the supply of gas to the Harton and Boldon districts. The report was adopted; and after the usual general business had been disposed of, an extraordinary meeting was held, at which the Directors were authorized to sell £10,000 of new stock and to issue £5000 of mortgage bonds as required. This step, it was stated, had been delayed for some time, from motives of economy; but it now became necessary, as the capital account was considerably overdrawn.

In moving the adoption of the report and accounts at the recent annual meeting of the shareholders of the Uxbridge and Hillingdon Gas Company, the Chairman (Mr. W. Fassnidge) remarked that, as compared with the year ending Dec. 31, 1892, the receipts for gas sold, for meter-rentals, residual products, &c., were more than in the previous year by £268. The quantity of gas sold, and brought to charge in 1892, was 33,412,300 cubic feet; and in 1893, 32,459,000 cubic feet—being a decrease of nearly a million feet. On the expenditure side of the account, the gross outlay was more than in 1892 by £286. This was accounted for by the renewals and repairs being heavier, and by having to specially purchase coal outside the contract during a short period of the miners' strike. With regard to the profit and loss account, after paying the debenture interest, &c., there remained £2616, which, with the surplus profit of the previous year, made a sum of £2658 to be disposed of by the shareholders, which was sufficient to pay the statutory dividends, amounting to £2586, and leave a balance of £64 to be carried forward.

The report of the Directors of the Walker and Wallsend Union Gas Company for the past year commences by expressing their regret at the loss they have suffered by the death, in October last, of their Chairman (Alderman Cail), who, from the origin of the concern, took an active interest in its welfare and progress. Concerning the year's operations, they point out that there has been an increase of income from the consumption of gas; while the expenditure has been on the most economical basis. Alterations and extensions at the Willington works have been completed, and the results of the working of the new plant

have proved very satisfactory. At the Walker works, new scrubbers have been erected; and at Wallsend, 12-inch and 3-inch mains have been laid, at a cost of nearly £1000. The report also announced that a sale of £5000 of stock took place in June last—realizing a total sum of £7903, which was an average of £158 1s. 3d. per cent. In accordance with the method adopted in previous years, the Directors again suggest that the sum of £500 be carried from profit and loss to the depreciation fund. An interim dividend of 4 per cent. was paid in August last; and the Board recommend that a similar dividend be declared for the second half year. They also propose that a reduction of 2d. per 1000 cubic feet be made to all consumers; and the charge will then be 2s. 10d., less 5 per cent. The report and recommendations were adopted at the meeting of the shareholders last Tuesday.

The shareholders of the Watlington and District Gas Company, Limited (of which Mr. Robert Fish, Assoc.M.Inst.C.E., is Chairman), held their ordinary general meeting on the 20th ult., when the Directors reported that the net profit for the year ending Dec. 31 last was £54; but as an interim dividend to the amount of £4 15s. had been paid, the total sum divisible was £49 5s. The Directors expressed their confidence in the ultimate success of the undertaking. The works had been put into a thorough state of efficiency; and it was hoped that a largely increased consumption would bring up the profits for the current year to a much better figure. A dividend at the rate of 5 per cent. per annum was declared.

Last Tuesday the Directors of the Wolverhampton Gas Company submitted a report to the shareholders which showed that the net amount of profit on the past half-year's working was £4435. The scarcity of coal during the colliers' strike, which commenced in July and continued for sixteen weeks, was a source of great anxiety to the Directors; and, in consequence of the highly increased price which they had to pay, through inability on the part of their contractors to supply, they were compelled to raise the price of gas by 3d. per 1000 cubic feet from Nov. 1 last—from 2s. 6d. to 2s. 9d. The usual dividends at the rates of 5 per cent. on the consolidated stock, and 3 per cent. on the preference shares were declared; and the sum required in addition to the £4435 to pay these, the Directors proposed to draw from the reserve fund. On the motion of the Chairman (Mr. H. W. Owen), the report was adopted.

Water Companies.

During the half year ending Dec. 31 last, the water-rents of the Maidstone Water Company amounted to £4907; and the profit on the working was £2213. At the credit of the profit and loss account is a sum of £5674; and from this a dividend of £4 16s. 8d. per cent. on the 10 per cent. shares and of £3 7s. 6d. per cent. on the 7 per cent. shares has been declared. These payments will absorb £2163, and make the dividend on the 10 per cent. shares £9 9s. 2d. per cent., as against £8 15s. for 1892, and on the 7 per cent. shares £6 12s. 6d. per cent., as against £6 10s. per cent. for 1892.

The proceedings at the annual meeting of the Newcastle and Gateshead Water Company last Tuesday were opened by the Vice-Chairman (Mr. W. D. Cruddas) with a reference to the death of the Chairman, Alderman Addison Potter. A short obituary notice appeared in the JOURNAL last week; but, from the remarks of Mr. Cruddas, we gather that Alderman Potter became a Director of the Company in 1863, and that his father was one of its founders. In a few well-chosen words, he acknowledged the deep interest which the late Chairman took in the Company's affairs. Turning to the report and accounts (see *ante*, p. 344), the Vice-Chairman said that the Company had expended during the past year £140,000 of capital. This large sum had been spent on the works they had in hand—largely, of course, upon the Rede extensions, where a very considerable portion of the pipe-line was laid to the new filter-beds at Whittle Dene. There was also the new line of piping from Whittle Dene to Newcastle, which was complete, and which went to make up the main items of expenditure. With regard to the capital, they had sold during the year £50,000 worth of 5 per cent. preference stock, upon which a large sum was realized as premium—in other words, the capital had been obtained in this instance at the rate of 3½ per cent. With respect to the revenue account, the increase in the income, considering all the circumstances, had been satisfactory. The Company had passed through a very anxious time. Their resources had been strained to the very utmost by the drought which came upon them about this time last year, and which till November last never broke. It was one of unprecedented length, at all events, in the experience of that Company, and one, so far as he knew, without an equal. Yet, despite the seriousness of the period, they had every reason to congratulate themselves upon the fact that their resources held out so well as they did. By pumping from the Tyne, they were able to fully supply water to the manufacturing works of the district—a consideration of vital importance in a place like that. The domestic supply was, of course, to a certain extent cut off at night; but only to a portion of the town, and merely for the purpose of restraining waste. When the Directors' report was written, the storeage of water was, he believed, about 800 million gallons; but now it was upwards of 1800 millions. Their full store, of course, was 3000 millions; but as the amount of water stored of late had been very satisfactory, they had no fear of any further trouble, while, besides, there was no restriction to the supply of the town in any way whatever. After the experience of the year, the Directors had, after full consideration, and on the advice of their Engineers, decided to abandon the small reservoir at the head of the Rede. They had therefore deposited a Bill in Parliament for power to construct a much larger reservoir at Cat Cleugh, which, holding 2000 million gallons, would increase their storeage capacity to 5000 million gallons. The extension of Gateshead required that there should be a greater supply to it; and they would seek power under the Bill to lay a large main pipe across the Tyne at Newburn, and along the south side of the river to Gateshead, which, being a duplicate supply, would really relieve Newcastle. An additional main-pipe extending from Whittle Dene to Newcastle would meet the increasing demand for water for manufacturing purposes. The capital under the Act which they hoped to get was limited to 5 per cent. dividend. On this occasion the dividend was a little lower. This, he thought, would hardly be a matter of surprise, considering that they commenced to pump last June, and that in this direction £6000 had already been expended. The report was unanimously passed; and a dividend was declared on the original consolidated stock at the rate of 8 per cent. per annum; on the 1876 stock at the rate of £5 12s. per cent.; and on the preference stock at the rate of 5 per cent. A resolution was then passed, empowering the Directors to raise a sum of £200,000 (part of the capital authorized by the Company's Act of 1889) by the creation and issue of £200,000 of 5 per cent. preference stock.

The half-yearly meeting of the Sevenoaks Water Company was held yesterday week. The report submitted by the Directors stated that there had been a small improvement in the receipts for water; and that several of the householders at Riverhead had availed themselves of the extension of the supply, and there was now a fair return on the capital outlay. The balance at the credit of the profit and loss account was £1343. Out of this the Directors recommended a dividend at the rate of 8 per cent. per annum on the consolidated stock, and £5 12s. per cent. per annum on the share capital. The report was adopted.

The half-yearly general meeting of the West Surrey Water Company was held last Tuesday, at the chief offices, 38, Parliament Street, S.W.—Mr. A. T. Simpson, M.Inst.C.E. (the Chairman) presiding. The Secretary (Mr. H. G. Thompson, Assoc.M.Inst.C.E.) having read the notice convening the meeting, the report was presented. It showed that the income for the six months ending Dec. 31 last was £3125; the expenditure, £1238—being increases of £233 and £235 on the amounts for the corresponding period of 1892. There were 93 new supplies connected, representing a future rental of £241 per annum. The Engineer and Manager (Mr. J. K. Hill, M.Inst.M.E.) reported that the whole of the plant was in good order. The amount available for division was £1971. The report was adopted; and dividends at the rates of 5 and 6 per cent. per annum were declared upon the preference shares, and at the rate of 4½ per cent. per annum upon the ordinary shares. Mr. J. W. Docwra was re-elected a Director; and Mr. E. P. Simpson was re-appointed one of the Auditors. A vote of thanks to the Chairman and Directors, as well as to the officers of the Company, concluded the meeting.

As the result of the working during the half year ending Dec. 31 last, the Directors of the Whitby Water Company are able to show a disposable balance of £2192, out of which a dividend at the rate of 8 per cent. has been declared. After paying this, a balance of £592 remains to be carried forward.

The half-yearly meeting of the Woking Water Company was held at the London Offices last Tuesday. Mr. Charles Horsley, J.P., presided; and, in moving the adoption of the report and accounts (see *ante*, p. 344), he said that the balance-sheet was the most favourable one that had ever been placed before the shareholders. The total expenditure on capital account had been £75,250. The revenue for the past year amounted to £5241; and the expenses, to £1969. The balance carried to profit and loss account was £3272. The working expenses were £133 more than in the previous year; and the water-rental had increased by £640. The amount for working expenses included several items which he did not think would occur again. Coals had cost more; and, in consequence of the dry weather last summer, they had had to hire special pumps to keep up the supply. During the drought, the amount of water used for gardens was very great indeed; and they had had to pump 100,000 gallons a day more than the usual quantity for that time of the year. New pumps and engines were being erected at West Horsley; and, when these were completed, the Company would be able to supply all the water that was likely to be required. Mr. R. Hesketh Jones seconded the motion, which was carried unanimously. A dividend at the rate of 4 per cent. per annum, free of income-tax, was then declared. This, it was stated, would absorb £1257, and leave £160 to be carried forward. The retiring Director (Mr. A. H. Baynes) and the Auditors (Messrs. W. Edmonds and W. H. Hardy) were afterwards re-elected.

The Pretended Gas-Meter Inspector.—At the County of London Sessions last Wednesday, before Sir P. H. Edlin, Q.C., Walter Coley, who was recently committed for trial on several charges of theft, and of fraudulently obtaining money from customers of The Gaslight and Coke Company, in whose employ he formerly was, by pretending to be one of their meter inspectors, was sentenced to nine months' imprisonment with hard labour. Only one indictment was proceeded with by Mr. Travers Humphreys, who prosecuted on behalf of the Company—viz., the charge of stealing a coat from the house of a Mrs. Sell, in St. Thomas's Road, Finsbury Park. Although the Company did not know it when they employed the prisoner, he had been twice convicted of larceny; but on each occasion he was bound over to come up for judgment if called upon.

The Extension of the Borough of Plymouth.—In October last the Borough Extension Committee of the Plymouth Corporation presented a proposal (subsequently endorsed by the Council) so to enlarge the borough as to more than double the area of the municipality, which at present consists of rather more than 1400 acres, and would be increased to 3165 acres. The districts with which it is proposed to deal comprise the areas at present governed by the East Stonehouse and Compton Gifford Local Boards, Egg Buckland, and certain extra parochial places, the government arrangements of which are peculiarly complicated. The extension of the boundaries, although it would more than double the area of the borough, would only mean an addition of about £89,000 to the present rateable value, which is £300,660; and the population would only be augmented by about 20,000, bringing up the entire population to 104,413. The whole of the extended area is within the limits of water supply of the Plymouth Corporation, as defined by their Water and Markets Act of 1867; and it is claimed (among other advantages) that the undertaking could be more economically managed, and the inhabitants supplied with water more satisfactorily, if the boundaries were extended as suggested. The Corporation forwarded a memorial to the Local Government Board on the subject; and this resulted in an inquiry by Major-General Carey, R.E. The proceedings commenced on the 21st ult.; and continued over several days. A number of eminent Counsel were engaged to represent the various bodies and individuals concerned; and the matter was exhaustively investigated.

CAGLIARI GAS AND WATER COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 3, Lothbury, E.C.—Mr. JOHN AIRD, M.P., in the chair.

The SECRETARY (Mr. W. B. Peat) read the notice calling the meeting; and the report and accounts, to which reference was made last week (p. 405), was taken as read.

The CHAIRMAN said he had the pleasure of placing before the shareholders a report which, like its predecessors, was a satisfactory one; and although they had had some difficulties to face during the past twelve months, nevertheless they had surmounted them, and with the result that as regarded the water department they had again realized an increase upon the year's working, and a still larger increase upon the gas department. It was also very satisfactory to be able to assure the shareholders that they had passed through the year retaining the good feeling (which the Directors valued so much) on the part of the Local Authorities, and of the people at large; and they had, he thought, shown their appreciation of this kind feeling by endeavouring to be of service to Cagliari. There was at one time during the year, some fear of cholera overtaking Cagliari, as it had taken hold of some other cities in the immediate neighbourhood; and he was sure the shareholders would sanction the course the Directors thought it right to take on that occasion by voluntarily offering to the Syndic and Prefect the opportunity of using water freely, and without charge, for certain public purposes, to at all events render the city as healthy as in the interest of the Company, they could desire it should be. The Directors were also anxious—some question being raised as to the quality of the water—to have it immediately examined; and the Minister himself selected a very distinguished gentleman (Professor Sclavo) to make the investigation. He went thoroughly into the matter; and in his report he declared that the water from the Cagliari aqueduct was one of the best potable waters in Italy, and remarkably free from organic matters, and containing no dangerous bacteria. The Directors, as the shareholders would understand, were extremely gratified with this result. They were also assured by the reports received from their representative (Mr. Craig), which were confirmed by their colleague, Mr. S. Simmelkjör, that the water-works were in all respects in a condition which would enable them to satisfactorily fulfil their obligations to the city and the surrounding district. The Directors felt that, although the increase of £210 in the water receipts in the past year might not be considered large, it was very satisfactory having regard to the very pleasant fact that they had year by year little additions, which had now assumed a very satisfactory amount in the accounts. With respect to the gas department, they had done exceedingly well. The increase had been £783; and this had largely accrued by the extended private consumption, and by the use of gas-stoves. He need hardly assure the shareholders that it would be the desire of the Directors to stimulate still more, through their representative, the use of gas for domestic purposes. The unaccounted-for gas had been reduced from 4½ to 4 per cent.; and their make for the year had been 9505 cubic feet per ton of coal carbonized, without the employment of cannel. The Directors had endeavoured to encourage the additional use of gas by giving a friendly hand to the fitting business, because, beyond increasing the supply, they held that the duty was thrown upon a gas company to see, in a city like Cagliari, where the people knew very little about it, that the gas-fitting was carried out in the best possible manner, in the interest of the consumer equally as for the benefit of the Company. Having mentioned that the amount of the wages in the gas department for the year had been lessened, he acknowledged the exertions of their Gas Manager (Mr. Webster), by whose ingenious charging machinery the Company had greatly benefited. A few months ago, he proceeded, the city had some thought of introducing the electric light for special purposes; and the Company had received the thanks of the Syndic for having offered to carry out a scheme on a small scale for the Opera and other large institutions. There, however, the matter rested for the present. He should say in connection with the gas supply that the Company might fairly take some credit for this: That, although they were only charging 5s. per 1000 cubic feet, by the terms of the concession, they could charge 9s. 7d. It might be said: Why not charge the larger amount, if you are entitled to it? Well, the Directors thought (and he hoped the proprietors would agree with them) that, by charging the smaller sum, they would increase the supply; and thus by helping the inhabitants, they would better help themselves. They had gone on now for some 25 years working in harmony with all the authorities; they had had no serious differences. Only occasionally little questions had arisen; but they had always been settled satisfactorily, mainly owing to the earnest attention and care which Mr. Simmelkjör had always bestowed upon their affairs. With regard to the accounts, the exchange had been somewhat against them; but although unhappily the financial condition of Italy was not what they could desire, nevertheless it had not affected them to any serious extent, as was proved by the Directors being able, on this occasion, to present accounts which showed a better result than any they had ever submitted before. He hoped that the difficulties of the country would be but temporary, and that they would soon pass away. As to the future, in the course of some two or three years, the Company would have to face a reduction of the guarantee which they received from the authorities; but the Directors had confidence, by the regular way in which the Company's earnings continued to grow, that, when that time came, they would still be able to place before the shareholders a result and dividend equally as good as at the present time, without even trenching upon the reserve funds. These had been gathered together in good times for use to a certain extent on rainy days, remembering also that the time would come when the capital ought to be represented by them, and when the guarantee of the City would pass away. In conclusion, Mr. Aird spoke in commendatory terms of the services of the various officials, and afterwards formally moved the adoption of the report and accounts.

Mr. F. WIGAN seconded the motion, which was at once unanimously carried.

A resolution was next passed confirming the payment of the interim dividend at the rate of 6 per cent. per annum, and agreeing to the recommendation that a dividend at the rate of 8 per cent. should be now declared, together with a bonus of 5s. per share.

On the motion of Mr. TOOTH, seconded by Mr. MORGAN, the retiring Directors (Messrs. John Orwell Phillips and S. Simmelkjör) were re-elected.

The customary complimentary votes were then accorded; and this concluded the proceedings.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly General Meeting of this Company was held on the 24th ult., at the Offices, Willoughby Lane, Tottenham—Mr. GEORGE GRIPPER in the chair.

The SECRETARY (Mr. J. Randall) read the advertisement calling the meeting; and it was agreed to take as read the Directors' report and the accounts, of which a brief notice appeared in last week's issue.

The CHAIRMAN said that, considering the position of the business generally, the report on this occasion was a tolerably favourable one, though at the same time it was not so flourishing as they had had in the past. As the shareholders would see, they had sold 2·88 per cent. less gas, which represented about £1000, and which the Board believed was due almost entirely to the absence of foggy weather last November and December and to the clear, bright days; and every clear, bright day then made a considerable difference in the income from gas. The number of consumers had made a fair increase; and they found a great deal of this was attributable to the new departure which he referred to at the previous meeting—viz., the adoption of prepayment meters. These were becoming very popular; and the Company were constantly receiving fresh applications for them. They were fixing them as fast as they could obtain them; the difficulty being to get a supply from the makers to meet the demand. These meters saved considerable responsibility and labour in the collection of accounts, as, previous to their adoption, they had a great many monthly accounts, which took up nearly the whole of the time of the collector. There had also been a steady increase in the value of the residuals. During the past three or four half years, they had had to constantly note a gradual decline in their price. But in the past six months, they had had an increase of about £1400 under this head, which was very gratifying. Coke had produced an additional £900; tar, £150; and sulphate, £325. The whole of the work connected with the construction of the new gasholder and tank had been satisfactorily completed; and the holder had been in use since the early part of December last. The Directors were perfectly satisfied that it was good work, and well done throughout. They were now taking in hand the carbonizing plant which was alluded to at the last meeting; and by the time the shareholders met again, he hoped to be able to say it was completed, and in working order. These were the only points in the report to which it was necessary for him to refer, excepting the last paragraph, and that he approached with sorrow. It referred to the resignation of their Deputy-Chairman (Mr. John Malcolm). They all knew the value of his wisdom and advice, and of his knowledge (acquired during his 38 years of office) of all matters that came before the Board; and it was to the Directors a matter of very great regret when Mr. Malcolm announced that, through failing health, he was obliged to retire. He (the Chairman) was sure the shareholders would all agree with him in expressing regret that Mr. Malcolm's infirmities had so increased as to compel him to take this course. At the same time his resignation threw upon the Board the onus of appointing a gentleman to fill the vacancy; and this they had done by electing Mr. J. B. Doe. He then concluded by moving the adoption of the report and accounts.

Mr. CORBET WOODALL, in seconding the motion, said the matter of most interest in the accounts was the fact that (he believed for the first time in the history of the Company) they had to record a diminished business. The Chairman had given one reason for this in the bright weather which prevailed during nearly the whole of last half year; and he (Mr. Woodall) believed that even gas shareholders would not be sorry to purchase those bright days at the expense of a slight reduction in the business of the Company. But he thought there was really another reason which would go some distance in accounting for this falling off—that the consumers were getting a little more scientific and careful in the burning of gas. The recent improvements in gas-burners had been very great, and they had had a striking influence in reducing the quantity of gas consumed in order to get a given amount of light; and he was quite sure that in many places, and in Tottenham to some extent, this had had an influence upon the consumption of gas. For his own part, he devoutly hoped that this adverse influence might go on increasing from time to time; for he was sure that the true interest of gas companies was to have their gas burnt by consumers in the most profitable manner. He also wished to say a word or two in regard to the fact that for the first time he occupied the place that had been so long filled by Mr. Malcolm. Of course, they were extremely sorry to miss his figure from among them, and to know they were not to have his advice any more. He thought, however, there was a certain satisfaction when a man, full of years, and with the respect of everybody who knew him, retired from active work, and left them under such circumstances as Mr. Malcolm had done.

The motion was unanimously carried.

Mr. J. WARREN proposed the declaration of dividends at the rates per annum of 11½ per cent. on the "A" stock and 8½ per cent. on the "B" and "C" stocks, less income-tax.

Mr. BAILEY seconded the proposition, which was agreed to.

Mr. MOORE, in the course of a few appropriate remarks, moved the following resolution: "That, having regard to the paragraph in the Directors' report of the 14th inst., informing the proprietors that Mr. John Malcolm has resigned his seat at the Board, the proprietors assembled at this meeting desire to place on record their sincere thanks to Mr. Malcolm for the faithful services rendered by him to the Company during his long term of office."

Mr. LAING seconded the motion; and it was unanimously passed.

The usual votes of thanks were passed to the Chairman and Directors, and to the Secretary (Mr. J. Randall), the Engineer (Mr. W. H. H. Broadberry), and their respective staffs.

THE DRIFFIELD LOCAL BOARD AND THE GAS COMPANY'S BILL.

A number of influential ratepayers of Driffield met the shareholders of the Gas Company last Tuesday, for the purpose of discussing the Bill the latter are promoting in order to obtain increased powers. Mr. J. Elgey was voted to the chair; and in the course of his opening remarks, he said that, if the Bill was opposed by the Board, the cost would be a very serious one, not only for the ratepayers but also for the Company. Mr. Brigham, the Chairman of the Company, said the Directors were prepared, if required, to reduce the additional capital sought to be raised. Another objection was that there was no provision for the lighting of the streets; and he had been unable to find in any Act such a clause. This was merely a matter of contract between the parties; and the Gas Company had never acted unfairly towards the town in this respect. With regard to the standard price, they sought to put it at 4s. per 1000 cubic feet, which was the same as in other places, but this was only a maximum. The price the people of the town were paying was 2s. 11d. per 1000 feet, while places situate in the heart of the coal districts were paying as much. They had made some inquiries as to what would be the cost of the Bill if it was opposed, and found that the Company would have to pay something like £2500 and the Local Board £1500. They were quite prepared to meet the Board in a reasonable way; and they were also ready to insert a clause in the Bill to the effect that, on the Board giving them written notice, they would sell the works to them. Some discussion followed; and it was resolved that a Committee should wait upon the Parliamentary Committee of the Board with a view of staying litigation, if possible.

Since the above meeting, the Local Board have intimated that, in order to bring about an amicable settlement between them and the Company, they are prepared to agree to the following terms, without prejudice: "(1) The Bill to proceed. (2) Clause 23 to be amended by reducing the additional capital from £18,000 to £8000. (3) In clause 41, reduce the power to borrow from £4500 to £2000. (4) Open to consider clause 36, standard price of gas, either with or without sliding scale as to dividend. (5) Will consider any suggestions as to insertion in the Bill of clauses as to providing and lighting street-lamps. (6) The piece of ground described as (*b*) in the second schedule to the Bill not to be used for the manufacture or storeage of gas or the manufacture of residuals. (7) To insert clause agreeing to sell the Company's works and undertakings to the Local Board, after notice, at a price to be agreed on; failing agreement, price to be fixed by arbitration, subject to the Local Board obtaining powers to purchase."

THE CROYDON COUNTY COUNCIL AND ELECTRIC LIGHTING.

Once more the Croydon County Council have had a discussion on the question of undertaking the supply of electric lighting; but with almost precisely the same result as on the previous occasion. A report on the subject was submitted to the members on Monday last week by the General Purposes Committee. It gave a history of the whole matter as it has been brought from time to time before the Council; and closed by stating that it would shortly become necessary to proceed with the lighting of the new Town Hall, and the Electric Lighting Sub-Committee believed there was a demand for the supply of the light in the Borough. The Committee, therefore, recommended that the Council proceed with the lighting of the compulsory area under the Order already obtained by the Corporation, and that application be made to the Local Government Board for sanction to a loan of £25,000 for the purpose. The adoption of the report was moved by Alderman Miller, who said there was no question but what the light was demanded by the inhabitants of Croydon; and if the burgesses wished for it, they ought to have it. In order to show that the electric lighting interest was growing in importance, he said that during the past twelve months applications had been made to the Local Government Board for sanction to an expenditure of £1,533,641 for electric lighting; and sanction had already been given for £939,191. At the present time, there were works in hand by local authorities to the extent of from £720,000 to £800,000. The electric lighting industry was getting a very important one, although it only started in this country eight or ten years ago; and at the present moment there were upwards of 5¼ millions invested in it in England. When they recollected the number of years that it had taken gas to grow up, and that at the present moment the gas undertakings of the country only represented investments to the amount of about 40 millions sterling, they might well agree that the electric lighting industry had enjoyed phenomenal success. Mr. Moss having seconded the motion, Mr. Howard Martin remarked that he had heard no fresh reasons for justifying the Council in altering the decision at which they previously arrived. He ventured to think that the Council on the last occasion were right in thinking that the report of the expert which was placed before them had been carelessly prepared, and was inaccurate; for the Chairman of the Committee, after hearing what had to be said against it, withdrew it, and the matter was not further debated. He spoke in favour of a private company being permitted to undertake the supply; and he moved an amendment referring the matter back to the Committee. This was seconded by Mr. Shirley, who could not see why £25,000 should be spent in the speculation of working up a small part of the borough. Alderman Layton thought that if they spent £25,000 it would entail a great loss for what would simply be an advertisement for a few tradesmen in the central area, for which those in the outlying districts would have to pay. He urged the Committee to leave the matter for a couple of years, and let them have peace for the time. Other members spoke for and against the recommendation; but in the end the amendment was carried by 22 votes to 19.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week the Edinburgh and Leith Gas Commissioners held a more than usually important meeting. The Commissioners are still troubled by residents in common-stairs burning gas after the hours for which they pay for it. In the southern district of the city, 31 per cent. of 3879 lights, which should have been extinguished at eleven o'clock, were found burning half an hour later; and of those, 15 per cent. were found burning after six o'clock in the morning. On a second inspection, after warning, 25 per cent. were found burning after eleven o'clock; and of those, 15 per cent. were burning after six o'clock. A second warning had been sent out; and all found burning after hours are now to be cut off. In October next, a scheme under which the Corporation propose to take over the lighting, will come into operation. This having been settled, the Commissioners plunged into the question of strike clauses in coal contracts, which was introduced by Mr. John Jamieson, by a motion that they should consider the desirability of inviting tenders for coal only from such companies and coalmasters as agreed not to insert strike clauses in contracts. In speaking to his motion, Mr. Jamieson said that during the last short coal strike in the West of Scotland, coal contractors took advantage of strike clauses; and the Works Committee had to go into the market and purchase coal at market rates, which cost the Commission £300. He thought they might assume that their contractors had coal, but sent it elsewhere for a higher price; and the consequence was that the public suffered. The operation of the strike clause was altogether inequitable. The certainty of being relieved from contracts, had a direct tendency to induce competitive tenders at ruinous rates, which must very likely be taken out by reductions in wages. Mr. J. N. Waterston, in seconding, said he saw bings at the pit-heads with his own eyes. It was a very usual thing for coalmasters to combine and hold their men out till they got quit of bings at enormous prices. He did not think it was fair that they should encourage that. That they should protect the capitalist against labour, appeared to him to be very unjust. Bailie Archibald thought the motion opened up a very important question. As a matter of fact, they did not invite tenders from anybody. If they were to put into their advertisements asking for tenders that they would not accept a strike clause, they might get no offers at all. He did not think they were prepared for that. He was told by the Engineers that most of the coalowners would not accept their contracts without a strike clause. The motion would be useful if it were altered to this, that strike clauses would be accepted only on the condition that contractors were to give their customers the preference before they supplied coal to outsiders. The Lord Provost pointed out that, if they were to abolish strike clauses, only very rich men could deal in coal, and prices would rise abnormally. At present, the Commission took the risk of a strike occurring; but if the coalowner were to take that risk, the Commission would have to pay more for their coal. Mr. Kinloch Anderson, in moving that they should consider the desirability of amending the strike clause as suggested by Bailie Archibald, said they had at present the power which Mr. Jamieson proposed in his motion, because they could reject any offer they liked. Mr. Anderson's motion was adopted. It is difficult to see what good it will do. Mr. Jamieson's contention that the public suffered during a strike was a very one-sided one, because it ignored the fact that the public would suffer more by the men being encouraged to strike, as they would be if they knew that their employers were under obligation to supply coal, no matter what price they might have to pay for getting it. Equally futile is Bailie Archibald's proposal; for if coalowners anticipated a strike, they could easily sell all their bing coal to a confederate, and so have none to fulfil their contracts with. A more feasible amendment of the strike clause appears to me to be to hold the contractors bound to supply coal during the strike, invoiced at the enhanced rate which would be chargeable in the event of the men succeeding; but in the event of their losing, subject to deduction of the extra rate. This would virtually be purchasing coal by a sliding scale, which is probably the best solution of the whole question. Such a scheme would deprive the coalowners of the temptation to foster a strike in order to temporarily raise prices, and get rid of surplus stocks; and it would prevent the men making a handle of the obligation of the coalowners to deliver. Of course, the enhanced price to be paid during the continuance of a strike would require to be fixed at the time the contract was entered into—so much per ton being added for the percentage upon their wages asked by the men.

Another subject of an unusual nature was brought up by Mr. Kinnaird, a new member of the Commission. He said that on visiting the Leith works, he was astonished to see that the men who worked at the retorts, when their work was done and they were sweating worse than tramway horses, had to sit down in the draught, and had to take their meals sitting upon dirty coal-barrows. He thought that a room might be provided into which they could go. Mr. Linton, the Engineer, explained that men who performed such work did not take cold in a draught, as any doctor would tell them; and it was necessary that the works should be free and open, for ventilation. The men worked eight hours, and had no meal hours, but took a lunch when they had time. If a room were provided for the men, that would take them away from their work. Mr. Kinloch Anderson thought they might consider the subject, in connection with the reconstruction of the Leith works; and this seemed to be the feeling of the meeting.

At a meeting of the Dumfries Gas Commission this week, Provost Scott, referring to the introduction of the Peebles oil-gas process, said it had proved very satisfactory. They had increased the illuminating power from 24 to 28 candles; and they expected it would reach 30 candles. With such good gas, there was no fear that people would go in for electric light.

The Melrose Gas Company, Limited, formed to take over and work the undertaking of the existing Melrose Gas Company, was this week registered as a joint-stock company. The capital is to be £2947, in £1 shares.

I am disappointed at one result of my "Note" last week on the

Ferguson cluster for gas-lamps. I learn that the Incandescent Gaslight Company do not adopt the cluster. I seem to have read the announcements in the local paper as meaning that they did; but I now find that the Princes Street hotels are lighted, not by the cluster lamps, as I supposed they were, but by single lamps on the Welsbach principle. My "Note" of last week was written in the belief that the parties were working hand in hand; not with the object of favouring one as against the other, but of calling attention to both.

A deputation of the Broughty Ferry Gas Commissioners on Wednesday visited Alloa and inspected the gas-works there, with a view to introducing new processes at home. The processes which were under consideration were the Peebles oil gas and Mr. G. R. Hislop's regenerative retort firing. The Commissioners had already resolved to introduce Mr. Hislop's settings; and what they saw at Alloa confirmed them in their resolution. They were also favourably impressed with the oil process. They could not have gone to a better place than to Alloa to see it at work, as I understand Mr. A. Yuill, the Gas Manager, has been most successful in its working.

On Tuesday night the electric lighting installation of the Aberdeen Corporation was inaugurated by a formal ceremony, performed by Mrs. Stewart, the wife of the Lord Provost. As yet the whole installation has not been got into serviceable order; and all that was lighted up were the ten street-lamps which have been completed. Before passing from the mention of these, it is impossible to avoid referring to the fatuity, or some other mental quality, which leads to their being described, as they were by Lord Provost Stewart at the opening ceremony, and as they are regarded by the whole public, as of 2000-candle power. Professor Kennedy was present at the opening ceremony; and one would have expected him to have exhibited his usual frankness, and put the community right upon that subject. In Aberdeen, the lamps are placed 80 yards apart, which is a longer distance than is usually adopted; but the ingenious explanation is given that it is expected that the white fronts of the granite houses will assist the light. This is, of course, nonsense; but it goes down with a gullible public. The reason given for the private lighting not being turned on at the same time as the public, was that all the wiring had not been completed. Of the private lighting, Lord Provost Stewart stated that they had made provision for 4500 8-candle lamps, which meant 7000 in use; and that they had applications for about 5000 lamps. The applicants number 36; and it is significant to note that one-fifth of these are public bodies in charge of large buildings, which will, among them, take a large proportion of the current. The public are therefore apt, unthinkingly, to assume that the undertaking is a successful one from the first, forgetting that a great deal of the success depends upon the public men who are responsible for the introduction of the light getting it put into public buildings, and paid for out of public funds. The Lord Provost intimated that the charge was to be 7d. per unit. A unit, he said, would keep an 8-candle lamp alight for 32 hours; and one unit was equal to 80 cubic feet of gas, which, at 3s. 8d. per 1000 cubic feet, was 3¼d. Now I quite grant that, if you burn a 2½-feet per hour burner, you will make 80 cubic feet of gas last for 32 hours; but I do not admit that the lights will be equal from such a burner and from an 8-candle electric lamp. With Aberdeen gas, I should expect a 2½-cubic feet per hour burner to give a light of about 12-candle power, which adds one-half to the cost of electricity, and makes it 10¼d. per hour for the same light as would be obtained in Aberdeen from gas for 3¼d. This reduces to an absurdity his Lordship's continuing sentence, that "at first sight that looked like double the price, and for a time clubs and shops might find it so; but private houses used less, because the light was always turned off, and, with care, might not cost more than gas." Of course, this kind of nonsense is always talked on such occasions; but the wonder is that people are so addle-headed as to believe it. There was one statement of fact, upon which the Corporation are to be congratulated. It is that, whereas the estimate of Professor Kennedy for the construction of the works was £24,500, the Lord Provost was able to announce that they would not cost more than £21,500. The installation consists of five engines—three of 80-horse power each, and two of 40-horse power each—coupled direct to the dynamos. A substantial building of granite has been erected beside the gas-works, for the housing of the plant, and the whole undertaking is under the charge of Mr. A. Smith, the Gas Engineer to the Corporation.

Opposition to the Thames Conservancy Bill.—At a special meeting held on the 24th ult., under the presidency of Mr. W. G. Mount, M.P., the Berks County Council considered a report by a Special Committee on the subject of the Thames Conservancy Bill, and unanimously adopted their recommendation that the Bill should be opposed on certain clauses, with the view of its amendment in the interests of the Upper Thames. A petition against the Bill was subsequently sealed.

Complaints as to Manchester Gas.—Complaints are being made in various quarters as to the quality of Manchester gas. At the meeting of the Manchester Section of the Society of Chemical Industry last Friday, Mr. Carpenter called the attention of the members to the matter before the regular business commenced. He stated that the Manchester and Salford Noxious Vapours Abatement Association had had the matter under consideration for a considerable time, and were doing all in their power to promote a wider knowledge of the deleterious effects of sulphur in gas. It appeared to him that the creation of a healthy public opinion on the subject was desirable; and he appealed to all the members of that Society, who had any knowledge on the subject, to put their information in the hands of Mr. Scott, the Secretary, who was trying to do away with the impurities in the air. Mr. G. E. Davies, after giving some statistics on the matter, said those who were responsible for supplying gas to the city ought to be compelled to take a very large quantity of sulphur out of the gas. In London, all but 16 or 18 grains per 100 cubic feet was extracted; and if the gas could be as pure as this in London, surely it could be greatly improved in Manchester. At the meeting of the Gorton Local Board on the previous evening, the poor quality of the gas was referred to; and it was decided to communicate with the Manchester Corporation on the subject.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 3.

Sulphate of Ammonia.—The market remains without change; and the position may be said to be most peculiar. Superficially there is a marked dulness of demand; and orders from some of the principal countries are conspicuous by their absence. Still the continuance of large shipments and the lowness of stocks are a striking feature. The requirements for this month should, in consequence of the hitherto desultory buying, be large. But it will not be easy to satisfy any considerable demand; and there may be some strange doings before the month is much older. There is apparently a larger consumption of nitrate, which is taken by interested parties as a conclusive proof that there will be a reduced consumption of sulphate; but it is far too soon as yet to take such a possible event for granted. The eve of such an exceptionally early season may precipitate matters speedily. The quotation for sulphate is £13 15s.; for nitrate, 9s. 6d.

LONDON, *March* 3.

Tar Products.—The feeling of weakness which has distinguished the tar products market of late, still continues; and products, for the most part, are all at easier prices. Benzols have never been known so low; and even at these minimum limits, buyers do not seem at all anxious to cover. Pitch is also weaker; but is in good demand, and several important sales have lately been effected for prompt and forward delivery. There is more inquiry for anthracene; but comparatively little actual business is reported. Carbolic acid and cresylic acid are both weaker; the latter especially so. Creosote and common oils share in the general depreciation of values, and can be had at lower prices than were lately current. Prices may be taken as follows: Tar, 12s. to 16s. Pitch, 27s. Benzols, 90's, 1s. 2½d.; 50's, 1s. 4d. Creosote, 1¾d. Creosote salts, 25s. Solvent naphtha, 1s. 2d. Toluol, 1s. 6d. Cresol, 1s. 1d. Crude benzol naphtha, 30 per cent., 6½d. Carbolic acid, 60's, 1s. 8d. Anthracene, 30 per cent., "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia.—The position of this article is wonderfully strong, having regard to the fact that buyers have held off from the market with the expectation of lower prices. With the price so firmly maintained in the absence of purchasers, there is every probability of much higher prices within the next few weeks, when buyers will be compelled to make their requirements known. To-day's price ranges from £13 15s. to £13 17s. 6d., less 3½ per cent. Gas liquor is quoted at 8s. to 9s. 6d. per ton, according to position.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—As anticipated in previous reports, the continued slackening off in the demand for all the better qualities of round coal, together with the increasing keenness of competition from outside districts, has compelled Lancashire colliery owners to make some revision of their list rates, to prevent business passing altogether out of their hands. This, so far at least as the Manchester district is concerned, has for the present, however, been restricted practically to house-fire qualities. In other Lancashire districts, although prices vary a good deal, according as they are regulated by the Coal Sales Association, all descriptions of round coal have been giving way to the extent of fully 6d. per ton upon previous quoted rates. At the pit mouth, best Wigan Arley coals can now be readily bought at 13s. to 13s. 6d.; Pemberton four-feet and seconds Arley, at 11s. 6d. to 12s.; common house-fire coals, at 10s. 6d. to 11s.; with steam and forge coals not averaging more than 9s. 6d. to 10s. per ton. As very few collieries have lately been working more than four days, and even with this restricted output stocks have accumulated, it is evident that some change of prices had become absolutely necessary; and whether any firm stand as regards contracts will now be made on the basis of the reduced rates, remains to be seen. As yet, however, there is practically nothing coming forward to really test the market. With regard to the shipping trade in round coal, this continues extremely dull; and on the Mersey, North Wales coal is offering at such low prices on the Birkenhead side, as to take away a good deal of the ordinary Lancashire business. It is therefore exceptional where more than 11s. per ton can be got for Lancashire steam coal, delivered at the Garston Docks or the High Level, Liverpool. Engine classes of fuel are necessarily less plentiful in the market, owing to the depression in the round coal trade; and this helps to harden up prices for all descriptions of slack. Colliery proprietors, where they have during the last month or so been making concessions, are now going back to their full list rates, which in many cases represents an advance of 6d. per ton on the basis upon which sales have recently been made. At the pit mouth, burgy averages 8s. to 8s. 6d; best qualities of slack, 6s. 3d. to 6s. 9d., up to 7s. and 7s. 3d. for some of the special sorts; and with ordinary common qualities, about 5s. to 5s. 6d. per ton. Following upon the action with regard to prices on the part of the principal Manchester colliery concerns—who are not members of the Lancashire Coal Sales Association—a meeting of the Manchester District Committee of the Sales Association, which is composed of representatives of collieries throughout Lancashire who sell in the Manchester district, was held on Friday; and it was decided that the delivered rates to consumers on all descriptions of round coal should be reduced 10d. per ton, and the prices to merchants for coal delivered at stations lowered 9d. per ton.

Northern Coal Trade.—There has been a little fuller trade in coal in the North-east during the past week. Vessels seeking coal cargoes were more numerous, and the shipments have been heavy in consequence; while the idea that there may be some advance in prices of coal through "combinations," has brought in rather larger orders in some cases. Northumbrian steam coals are quoted at 10s. 6d. per ton f.o.b.; but some sales have been made at a few pence less to secure work to keep the collieries going. Second-class steam coals are 1s. per ton lower; and small steam coals have risen in price from 3s. 6d. to 4s. 3d. per ton f.o.b., in expectation that the coalowners will combine to maintain a minimum price for this class of fuel, which has

been selling at a low rate since the end of the year lessened the demand from the Midlands. In gas coal, the efforts of the makers have so far been successful in maintaining the price at from 7s. 3d. to 8s. per ton; but it will be when the competition arises for the contracts for shipment to places such as Rotterdam, that the difficulty of maintaining a price in the face of competition with other coalfields, home and foreign, will be most felt. Gas coal is still in fairly good demand; and the collieries yet keep at tolerably regular work. There is rather a fuller inquiry for manufacturing coals; and prices are steadier, though not quotably higher, as the production is still large. Coke rather varies in position. The export demand is limited; but there is now an increased consumption in the local iron trade, and rather better accounts of the North-western iron trade seem to arrive. For export, the price of best Durham coke varies from 14s. 6d. to 15s. per ton. The demand for gas coke for manufacturing purposes is steady; and as the production is less than it was, the stocks are kept low. There is no alteration this week in the price of gas coke.

Scotch Coal Trade.—Receding prices are still the rule in the coal market in Scotland. Foreign orders are not coming in so plentifully as coalowners would desire; a good many of those which used to be secured by Scotch coalowners going to the Tyne district. It may be said that the miners have practically given up their demand for 6d. per day advance in wages. A meeting of delegates was held this week; but it was adjourned for a week on some not very potent excuse. On the other hand, the masters in the Slamannan district have declined to meet certain of the men's leaders. These circumstances, coupled with the fact that it has been found necessary to announce the annual spring reduction in the price of house coal by 1s. per ton a month earlier than usual, goes to show that there is little hope of the men succeeding in their demand. Still, until this is withdrawn, there is a feeling of uneasiness which cripples coalowners in accepting long contracts, and week by week throws more coal on the market. The prices quoted are: Main, 7s. 3d. to 7s. 6d.; ell, 8s. 6d.; splint, 8s. 6d. to 8s. 9d.; and steam, 9s. 3d. per ton, f.o.b. Glasgow. Shipments for the week amounted to 137,895 tons—an increase on the previous week of 26,458 tons, and on the corresponding week of 1893 of 33,671 tons. For the year to date, the total shipments have been 1,018,451 tons—an advance over the corresponding period of last year of 251,525 tons.

Changes of Address.—Owing to the expiration of the lease of the offices of The Gas Institute at No. 3, Victoria Street, Westminster, the Council have engaged rooms at No. 13 in that street—four doors from the old address—where the Secretary (Mr. F. G. Burfield) requests all communications to be sent in future.——The offices of the Singapore Gas Company, Limited, have been removed to No. 98, Cannon Street, E.C.

Extension of the Retford Gas and Water Works.—Owing to the necessity for more storeage room at the Retford Gas-Works, the Gas Committee of the Corporation have decided to erect a two-lift telescopic gasholder, similar in construction to the one put up two years ago. The present holder has a capacity of 75,000 cubic feet, while the second holder, when complete, will contain 137,000 cubic feet. It is to be constructed on the most approved modern lines—practically all of wrought iron, with some steel where necessary. Tenders are now being invited for the work, according to drawings prepared by the Manager (Mr. J. B. Fenwick), who also designed the smaller holder. Although there is an unlimited supply of water to be obtained at the water-works, the Water Committee have thought it necessary to provide further storeage room for cases of emergency, such as that of fire, and are now providing means of storing an additional quantity of 20,000 gallons by driving into the sand rock headings which may at any future time be extended. The works now consist of duplicate wells connected together. Each is 80 feet deep, and has a borehole 250 feet deep; making a total depth of 330 feet into the water-bearing strata of the red sandstone. The yield of the springs is between 18,000 and 19,000 gallons per hour of pure water. There are also duplicate engines, with ample steam power to run them together if required. The water is raised into a tank, having a capacity of 100,000 gallons, to a height sufficient to give by gravitation an average pressure of 50 lbs. per square inch in the town. The new works were designed by Mr. Fenwick, by whose staff they are being carried out.

Salt Lake and Ogden Gas and Electric Lighting Company.—The second general meeting of this Company was held last Friday, at Winchester House. Our reporter was refused admission (the meeting being stated to be a private one); but we have since learnt that it was not so unanimous as it might have been. The shareholders, being the owners of the American Company, appear to think that they ought to receive a copy of the accounts of the latter Company, which have been audited by Messrs. Kemp, Ford, and Co.; and after the Chairman's opening address, in which he congratulated the proprietors upon the flourishing state of the undertaking, a shareholder demanded that the accounts of the American Company, showing the working of the concern, should be circulated among the shareholders of the English Company. This was seconded by another shareholder, who spoke equally strongly upon the same point. Mr. E. H. Stevenson (of Messrs. Stevenson and Burstal, of Westminster), who inspected the properties before the purchase was made, commented upon the fact of the Directors having sent out Mr. W. O. Rooper, an emery-wheel manufacturer, of Stafford, to report upon the works and undertaking, and the best method as to their future management. Colonel Sutherland strongly urged the Directors to circulate the balance-sheet as asked for; and the vendor spoke in favourable terms of the future of the undertaking. The Chairman, in reply, declined to produce the audited accounts of the American Company, or to circulate them among the shareholders. He stated, however, that any of the latter might see the accounts, but might not take either a copy or notes of them. He also defended the action of the Board in sending out Mr. Rooper to report. It was thereupon moved by Mr. Burstal, and seconded—"That the reports and accounts be received, but not adopted." Upon a show of hands, this was defeated—we believe by a majority of one; a shareholder pointing out that every shareholder present, other than the Directors, voted for the amendment.

Proposed Experiments with Oxy-Oil Gas at Bradford.—The Gas and Electricity Committee of the Bradford Town Council are considering the advisability of experimenting with oxy-oil gas as an enricher. A Sub-Committee who were deputed to inquire into the subject, and who have visited the St. Helens and the Huddersfield Gas-Works, reported the information they had obtained to the whole Committee last Friday; but before making a definite recommendation, they wish to make further investigation.

Exhibitions of Gas Appliances.—An exhibition of gas cooking and heating stoves was opened in the Central Hall of the Corporation Art Galleries, York, on Monday last week, by the Lord Mayor (Alderman Clayton, J.P.), who was accompanied by Mr. Charles Sellers, the Manager and Secretary of the York Gas Company. The stove exhibits were supplied by Messrs. C. Wilson and Sons, of Leeds; and a large collection of burners was furnished by Messrs. G. Bray and Co., of the same town. In opening the exhibition, the Lord Mayor delivered a very interesting address, at the close of which Miss Peacock, of the Yorkshire School of Cookery, gave the first of a series of lectures. These were continued every day during the exhibition, which remained open till Saturday. Last Tuesday, a display of domestic gas appliances was opened in the Buxton Town Hall; and their usefulness was well demonstrated by Miss Shaw, of the Nottingham School of Cookery.

The Sewage of Staines.—In the Queen's Bench Division of the High Court of Justice on Monday last week, an application was made to Justices Mathew and Cave, on the part of the Local Government Board, for a peremptory *mandamus* to the Staines Local Board to obey an order of the Local Government Board of December, 1891, to execute certain works of drainage, and there was a *mandamus* issued in August, 1893; and the Local Board now made a return, the effect of which was that they required time to prepare a scheme and estimate for obtaining the necessary funds, &c. The Attorney-General (Sir C. Russell, Q.C., M.P.), with Mr. Sutton, now moved for a peremptory writ of *mandamus*, pointing out the delay which had already taken place. Mr. H. Tindal Atkinson for the Local Board, endeavoured to support the position they had taken. But their Lordships said it was quite impossible to support the return; and a peremptory writ of *mandamus* must issue.

Additional Water-Works for Larne.—A special meeting of the Larne Town Commissioners was held a short time since, for the purpose of considering a petition to the Local Government Board, asking to be allowed to put in force the Lands Clauses Consolidation Acts with respect to the purchase of lands and application for a loan with the object of extending the water-works. For some time past, the inhabitants of the town have been put to considerable inconvenience owing to the scarcity of water at the Sallagh Springs, whence the present supply is obtained. The Commissioners commenced in a thorough business-like manner to rectify this state of affairs; and Mr. L. L. Macassey, of Belfast, was engaged to formulate a suitable scheme. As a result of his labours, the Commissioners propose to acquire several springs from which they expect to procure a constant and abundant supply. The petition was presented in due course, and an inquiry was held last Tuesday by Mr. C. P. Cotton, one of the Inspectors of the Board, relative to the application. The Town Commissioners ask for sanction to the borrowing of £5100 to defray the cost of acquiring the springs and carrying out the necessary works.

New Water-Works for Carlisle.—The Water Committee of the Carlisle Corporation have agreed to recommend a gravitation water scheme for the city at a cost of about £110,000, involving an annual charge for 50 years of upwards of £6000, and a temporary loss to the district fund of £525 per annum. At the present time, Carlisle is supplied with water from the River Eden, collected in filter-beds on the Steney Holme, close to the town, and thence pumped to the consumers. The water is abundant in quantity and excellent in quality; but the pumping machinery, which has been in use for many years, is said to be worn out and unsuitable for present requirements. To meet the difficulty, two schemes are practically before the inhabitants, both the work of Mr. J. Mansergh. One scheme is to renew the pumping machinery, and make it adequate, at a cost of £84,000, which could be borrowed without an Act of Parliament, but, it is believed, only for 30 years. The other scheme is the gravitation one, for which an Act would be required, which would, it is considered, spread the repayments of the sum which would be borrowed over 50 years. The proposed source is the head of the River Caldew, in Mosedale, some 20 miles to the south-west of Carlisle. Inspections have been made of Mosedale; and it is thought the scheme would afford a supply of 2½ million gallons per diem of water pronounced to be a "high-class mountain water, free from all evidence of pollution, past and present."

The Quality of the Wakefield Water Supply.—During the past two or three months, there has been considerable agitation in the outlying districts of Wakefield on account of the turbid condition of the water supplied. Two or three meetings of representatives of the Local Boards have been held. at which resolutions have been passed calling upon the Corporation to abate the "evil" by filtration, or the Board would feel it incumbent upon them to obtain water from other sources. It appears that the turbidness was due to the heavy rains succeeding the prolonged dry weather; and the Water Committee admit that, although it was not necessary to filter the water prior to October last, it is desirable that it should be done now. They accordingly instructed their Engineer (Mr. Rofe) to consider the best means of carrying this out. This he has done; and he reports that he has projected works upon the principle of "slow filtration;" and they have been designed not only with the view of preventing any turbidity of the water in the future, but also with the object of counteracting the action of the water on lead. He recommends that six filter-beds be constructed, each having a sand area of 2445 square yards, the water to pass through a thickness of not less than 6 feet of filtering material (including sand of a minimum thickness of 3 feet), at a maximum rate of 33½ gallons per square foot of sand per 24 hours. The cost of filtration, including maintenance, he estimates at about 0·5d. per 1000 gallons. At a special meeting of the Council last Tuesday, the Water Committee were instructed to take early steps for securing the efficient filtration of the water at Jaw Hill and storeage at Lindle Hill.

The Site for the Electric Lighting Works at Chester.—Notwithstanding the offer of the Chester Corporation Electric Lighting Committee to leave a space of 40 feet between their proposed central station and the Walls, and to beautify the exterior of the building, the antagonism of the Dean and Chapter of the Cathedral to the Hoppole Paddock site has not abated. At the last meeting of the Town Council, a letter was read from the Dean and Chapter to the effect that if the Council for any reason did not follow the recommendation to utilize this site for the works, their offer to apply for the sanction of the Ecclesiastical Commissioners to acquire the paddock as an open space, and otherwise to improve the Kaleyard approach, would not be overlooked, as they were ready to make such application when it was open to them to do so. The letter was referred to the Improvement Committee for consideration.

Southampton Corporation Water Department.—The report of the Water Engineer of the Southampton Corporation (Mr. W. Matthews) for the past twelvemonth contains some interesting information. It states that at the close of the year, 69,000 persons were being supplied with water, as against 65,800 in 1892, 64,900 in 1891, and 64,200 in 1890; while between 1890 and 1893 the number of houses to which water was laid on was raised from 12,970 to 13,435. The rainfall of 1893 was 20 per cent. below the average; but the wells and headings at Otterbourne yielded an ample supply—being drawn upon to the extent of nearly 3,500,000 gallons per day. Last year 998,300,000 gallons were pumped—100,000,000 gallons more than in 1892, and comparing with 805,250,000 gallons in 1890. The estimated consumption per day for domestic purposes is 30½ gallons, which is a liberal allowance. The works at Mansbridge were entirely discarded last year; and as they involve an outlay of nearly £80 a year for maintenance, Mr. Matthews suggests that some steps should be taken to relieve the rates of this burden. The cost per 1000 gallons supplied in 1893 was 0·339d. Meter supply last year brought in an increased revenue of upwards of £1300. The total working expenses came to 1s. 4¾d. per head of the population in 1893, against 1s. 5½d. in 1892, 1s. 5d. in 1891, and 1s. 5¾d. in 1890. The charges for repayment of capital and interest last year amounted to £8164, against £8017, £7982, and £8297 respectively in the three previous years.

An Electric Lighting Scheme for Beckenham.—Mr. Gisbert Kapp has reported to the Beckenham Local Board on the question of supplying the district with electric light, under their recently acquired Provisional Order. He recommends the Board to carry out an installation; but he is careful to inform them that for about two years they will be working at a loss, after which they will commence to reap a profit. His scheme is divided into two stages; and he bases his figures on the following estimates: That in the first stage 100 houses will be served, with 2650 10-candle power lamps, and a revenue of £1260; and that in the second stage 460 houses will be supplied, with 13,500 lamps, and a revenue of £6610. He recommends a high-pressure alternating current supply, and places the capital expenditure on the first stage at £11,000 and on the second stage at £27,000. His computation as to the working expenses shows that there would be a loss of £448 per annum on the first stage; while on the second stage a profit of £2717 would be realized. Mr. Kapp tells the members what ought to be patent to all of them, that "the question whether the undertaking will result in a loss or a profit depends entirely upon the amount of custom obtainable from the residents in the district." It is amusing, too, to read that "a continuous supply may become necessary in the district, if a general demand for electric heating and cooking or motive power should arise. These developments may, however, *safely be left to the future*." The Electric Lighting Committee of the Board are still considering the matter.

The Opposition to the Birmingham Water Scheme.—Concerning the correspondence which recently passed between Mr. Howard Lane and the Mayor of Birmingham, the former gentleman has since placed himself in communication with the Local Government Board, with the view of obtaining from them authority to make a roving inspection of the accounts and documents of the Water Committee in connection with the promotion of the Elan water scheme, and particularly with a view to informing himself as to the remuneration to be paid to the Engineer (Mr. J. Mansergh). The Local Government Board have replied to the effect that they have no authority in the matter; but they direct Mr. Lane's attention to clause 235 of the Birmingham Consolidation Act, 1883, which prescribes: "(1) The Corporation shall cause to be kept true accounts of their receipts and expenditure under this Act; and the books of account shall at all seasonable times be open to the inspection of any ratepayer of the borough. (2) In the month succeeding the month in which the accounts are made up in every year, a full abstract shall be made in writing of such accounts for the preceding year, and a copy thereof shall be deposited with the Town Clerk, and shall be open to the inspection of all persons interested, and shall be published in one or more local newspapers circulating in the borough." Upon this Mr. Lane addressed a letter to the Town Clerk on the 20th ult., informing him that he should attend at his office and that of the City Treasurer on the next day, to obtain the following information from the various documents: "(*a*) The sums of money paid up to date to Mr. Mansergh for evidence and as commission in connection with the Welsh water scheme. (*b*) The sums of money, in detail, paid to the various parliamentary witnesses for their evidence during the promotion of the Welsh Water Bill. (*c*) The sums of money paid to the various landowners to date for land and rights taken over by the Birmingham Corporation for the purpose of the Welsh water scheme. (*d*) The sums of money or other consideration agreed to be paid to Mr. Mansergh by the Water Committee of the Corporation, either for evidence (parliamentary) for preparing the case for the promoters, for reports leading up to the establishment of the scheme, or as commission for acting as Engineer during the construction and installation of works." He added that it was contended by himself and certain ratepayers that this information had been illegally suppressed. Mr. Lane and other gentlemen accordingly attended the offices; and facilities were given for the various account books in the Treasurer's department, as well as the ledger from the water-works office, to be inspected. The minutes of the Council were also submitted; but the request to see those of the Committee was not acceded to—these not being books of account.

Opposition to the London County Council's Water Bill.—The Middlesex County Council, having failed to come to terms with the London County Council as to the provisions of the Bill now being promoted by the latter body for a new supply of water for London, have resolved to oppose the Bill; and they have instructed Counsel to represent them before the Committees of the two Houses.

Sale of Shares.—At a public sale of shares at Norwich last week, five £20 fully-paid shares in the *British Gaslight Company* were disposed of at £44 2s. 6d. and £44 5s. each; 45 £10 ordinary fully-paid shares in the *Norwich Water Company* realized from £17 12s. 6d. to £17 17s. 6d.; and 50 5 per cent. £10 fully-paid preference shares in the *Lowestoft Water and Gas Company* fetched from £14 to £15.

Chorley Gas Supply.—At the last monthly meeting of the Chorley Town Council, Mr. Kirkman, in moving the adoption of the proceedings of the Gas Committee, stated that they were making 993 cubic feet more gas per ton of coal than previously. Although there was a deficit of £245 on the financial year, there was a redeeming feature in the fact that they had paid out of revenue a loss of £641 caused by the coal stoppage. The total deficit was £1172; but it was hoped that they would be able to clear this off during the year. The supply of gas by "penny-in-the-slot" meters was extending; there being now 59 meters at work. The motion was agreed to.

The Progress of Electric Lighting at Burnley.—Some particulars are furnished with regard to the Burnley Corporation electric lighting scheme. The new illuminant was first brought into use in August of last year, since which time there has been considerable extension. Mains have been laid in 14 of the principal thoroughfares in the town; and altogether nearly 6 miles of cable have been put down. The charge is 6d. per Board of Trade unit, measured by meter; consumers being connected to the mains free, and supplied with meters at a small rent. A reduced price of 4d. per unit is charged for the current consumed during the daytime. The works are capable of serving 6300 lights simultaneously; but at the present time they are seldom called upon to supply more than 2000 at one time. A return shows that for the month ending January there were 58 consumers with 3751 lamps; and the electricity used was 7445 units. The maximum output in any one day was 399 units—on Saturday, Jan. 27.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 428.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	„	7½	Do. 7 p.c	10	12—13	..	5 15 5
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 6
100,000	20	14 Dec.	8	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	15 Nov.	6½	Bombay, Limited	5	4¾—5	..	6 10 0
40,000	5	„	6½	Do. New	4	3¾—4	..	6 10 0
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	215–220*	+3	5 4 6
180,000	„	„	8½	Do. New	100	160–165*	+1½	5 3 0
220,000	Stck.	15 Sept.	11½	Brighton & Hove Original	100	210–220	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	101–104*	+1½	4 16 2
320,000	20	29 Sept.	11½	British	20	46–48	+2	4 13 9
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19–21*	..	5 9 6
51,510	10	„	8½	Do. 7 p. c.	10	15–16*	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½–6½	..	3 1 6
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	98–101	..	5 18 10
150,000	20	28 Feb.	8	Cagliari, Limited	20	26–27*	..	5 18 6
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	252–257	+2	4 17 3
165,000	„	„	9½	Do. New do.	100	192–196	+1½	4 17 0
160,762	„	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	128–133	..	3 7 9
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	230–235	..	5 10 7
200,000	„	„	10	Do. 7 p. c. Pref	100	203–207	..	4 16 7
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	102–107*	+½	4 13 5
486,090	10	31 Jan.	10	European, Limited	10	22–23	..	4 6 11
354,060	10	„	10	Do. Partly paid	7½	15½–16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	229–234	+1	5 2 6
100,000	„	„	4	Do. B, 4 p. c. max.	100	97–100	..	4 0 0
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	273–278	..	3 12 0
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	130–135	..	3 14 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	190–195	..	3 16 11
1,300,000	„	„	7	Do. H, 7 p. c. max.	100	171–176	+1	3 19 6
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	270–275	+1	3 12 9
476,000	„	„	6	Do. K, 6 p. c. Prf.	100	163–168	..	3 11 5
1,061,150	„	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127–130	..	3 1 6
894,850	„	„	4½	Do. 4½ p. c. do.	100	130–135	..	3 6 8
908,000	„	„	6	Do. 6 p. c. do	100	175–180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	211–216	+1	5 11 1
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4¾–5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	109–111	..	4 10 1
541,920	20	15 Nov.	5	Monte Video, Limited	20	12½–13½	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6–6½	..	6 3 1
60,000	5	29 Sept.	7	Ottoman, Limited	5	4–4½	..	7 15 6
166,870	10	31 Jan.	2	Pará Limited	10	1¾–2¼	..	8 17 9
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	98–102	..	5 17 8
500,030	100	1 Dec.	6	and Do.	100	96–100	..	6 0 0
150,000	10	13 Oct.	5	San Paulo, Limited	10	8–9	..	5 11 1
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	308–313*	+3¾	4 19 0
1,350,000	„	„	12	Do. B do.	100	250–255*	–1	4 14 1
260,000	„	„	13	Do. C do.	100	256–261*	+1½	4 19 7
750,000	„	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	150–153	..	3 5 4
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210–215*	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	272–277	..	3 12 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	218–223	..	3 11 9
544,440	„	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147–150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	112–116	–2	3 13 4
708,000	Stck.	28 Feb.	11½	Kent	100	288–293*	..	3 18 6
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	250–255	..	3 14 6
406,200	100	„	7½	Do. 7½ p. c. max.	100	200–205	..	3 13 2
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	130–134	..	2 19 9
500,000	100	14 Feb.	12½	New River, New Shares	100	365–370	..	3 5 6
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	132–135	..	2 19 3
902,300	Stck.	14 Dec.	6	S'thwk & Vxnall, 10p. c. max.	100	158–163	–2	3 13 7
126,500	100	„	6	Do. D 7½ p. c. do.	100	147–152	..	3 19 0
1,155,066	Stck.	14 Dec.	10	West Middlesex	100	265–270	–3	3 14 1

*Ex div.

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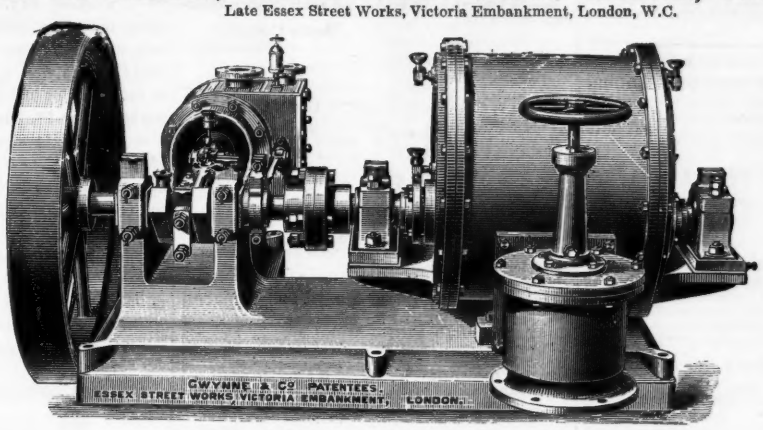
The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



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WANTED, a Situation as Manager of Gas-Works of medium size or position of trust on large Works. Experienced in all branches. First-class references. Married.
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WANTED, by the Son of a Water-Works Engineer, a Situation as ASSISTANT or otherwise, in the Office of a Water-Works Engineer or Manager. Has had four years' experience on Public Works and in General Office Routine. No objection to going abroad.
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*** See Advertisement, p. III. centre of JOURNAL.
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WANTED, a Draughtsman and Clerk. Apply, stating Salary required, Age, previous experience, and enclosing two original testimonials as to ability and character, on or before the 13th inst.
WM. W. GRAY,
Engineer and Manager.
4, Benet Street, Cambridge,
March 1, 1894.

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WATER-WORKS Engineers are invited to send in SCHEMES for SUPPLYING the Town of LEDBURY with WATER. The author of the Scheme which is approved by the Rural Sanitary Authority, and passed by the Local Government Board, shall be appointed Engineer for the work.
Particulars of RICHARD HOMES, Clerk to R.S.A., LEDBURY.

KENT WATER-WORKS.

THE Directors of this Company are about to appoint a SUPERINTENDENT of WASTE INSPECTORS for part of their District.
Applicants must have a thorough practical knowledge and experience of Deacon's Waste-Water Meters, and the System of Waste Detection in connection therewith, be capable of directing its application, keeping the Records, and serving the necessary Notices. Age limits, 25 to 40.
Applications, stating past experience, terms, and other particulars, together with testimonials, to be addressed to the Engineer, Kent Water-Works, Deptford, London, S.E.
ALEXANDER DICKSON,
Secretary of the Company.
Feb. 28, 1894.

CORPORATION OF STOKE-UPON-TRENT.
(GAS DEPARTMENT.)

WANTED, a Manager. Salary £200 per annum, with House, Rates, and Gas free.
Applications, with copies of three recent testimonials, to be sent on or before the 10th of March, endorsed "Gas Manager," to Alderman H. C. FARAM, Chairman of the Gas Committee, STOKE-UPON-TRENT. Canvassing a disqualification.

SLOUGH GAS AND COKE COMPANY.

WORKING Manager required. Annual make about 19 millions. Wages to commence £2 per week. House, large Garden, Coals, and Gas free.
Applications, with not more than three recent testimonials, addressed to the Chairman, R. Martin, Esq., Castleview, Chalvey, near Slough, endorsed "Application for Manager," to be delivered on or before Tuesday, the 20th inst.

ARTHUR THOMAS,
Secretary.

Feb. 28, 1894.

GAS-WORKS in small Town in Shropshire FOR SALE by TENDER as a going Concern, through failing health of Proprietor.
Apply to C., "*Guardian*" Office, DROITWICH.

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TO PIPE FOUNDERS.

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Particulars may be had on application.

BENJAMIN CARVER, Jun.,
Chairman of the Board of Directors.

Gibraltar, Feb. 22, 1894.

CORPORATION OF SOUTHPORT.

THE Gas Committee invite Tenders for Twelve Months for the following:—
SULPHURIC ACID,
JOBBING CASTINGS.
Specifications may be had on application to the undersigned, to whom endorsed tenders must be sent not later than March 12 next.

JOHN BOOTH,
Engineer.

Gas-Works, Southport.

MORLEY GAS COMPANY.

SPENT OXIDE.

THE Directors of the above Company invite TENDERS for the purchase of about 100 tons of SPENT OXIDE.
Further particulars may be obtained from the undersigned, to whom tenders must be sent not later than Saturday, the 10th of March.

H. J. HEMINGWAY,
Secretary.

Gas Office, Morley, near Leeds,
March 2, 1894.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Padiham and Hapton Local Board invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR to be produced at the Gas-Works, Padiham, during the Year ending March 25, 1895.
Sealed tenders, addressed to the Chairman, Gas Committee, Local Board, Padiham, must be sent to me not later than Saturday, March 10, 1894.
For particulars, apply to

J. R. SMITH,
Clerk to the Board.

Padiham, Feb. 21, 1894.

GLASGOW CORPORATION GAS.

TAR AND AMMONIACAL LIQUOR FOR SALE, AND RESIDUAL PRODUCT WORKS TO LEASE.

THE Glasgow Corporation Gas Commissioners are prepared to receive TENDERS for (1) the purchase of the TAR and AMMONIACAL LIQUOR produced at the DALMARNOCK GAS-WORKS from and after July 1, 1894; (2) the purchase of the TAR and AMMONIACAL LIQUOR produced at the DAWSHOLM and TEMPLE GAS-WORKS from and after July 1, 1894, and a LEASE of the RESIDUAL PRODUCT WORKS belonging to the Commissioners adjoining these Gas-Works from and after same date; (3) the purchase of the TAR and AMMONIACAL LIQUOR produced at the TRADESTON GAS-WORKS from and after July 1, 1894, and a LEASE of the RESIDUAL PRODUCT WORKS belonging to the Commissioners adjoining these Gas-Works, from and after same date; and (4) the purchase of the TAR and AMMONIACAL LIQUOR produced at the POLLOKSHAWS and OLD KILPATRICK GAS-WORKS from and after May 15, 1894.
Forms of Tender, on which offers must be made, and copies of the "Terms and Conditions" upon which the Tar and Liquor are to be sold and the Works are to be let, may be had on application to the Manager at the Gas Office, 45, John Street, Glasgow; and offers, endorsed "Tenders for Tar and Ammoniacal Liquor, &c.," will be received by the subscriber on or before Tuesday, the 20th of March next.
The Commissioners do not bind themselves to accept the highest or any tender.

J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow,
Feb. 24, 1894.

TAR AND AMMONIACAL LIQUOR.

TENDERS are invited for the Tar and AMMONIACAL LIQUOR to be produced at the Gas-Works, Seaford, for One Year commencing Lady-day next—free on rail at Seaford Station in purchasers' own (ordinary sized) Petroleum Barrels of 40 gallons each—at per barrel.
Sealed tenders to be sent to me not later than Saturday, March 17.

JAMES COWNEY,
Manager.

Gas Office, Seaford, Sussex.
Feb. 28, 1894.

THE Westerham Gas and Coke Company, Limited, invite TENDERS for the Supply and Setting of a BED of FIVE BEST STOURBRIDGE FIRE-CLAY RETORTS, with the necessary Bricks, Fire-Clay, &c.
Specifications may be had on application to the undersigned.
Endorsed tenders to be sent in by the 4th of April.
By order,

CHAS. HOOKER,
Secretary and Manager.

Westerham, Kent.

THE Hindley Local Board are prepared to receive TENDERS for the supply of FIRE-CLAY, RETORTS, FIRE-BRICKS, &c.
For particulars, apply to Mr. W. Dickinson, Gas and Water Manager.
Sealed tenders to be sent to the undersigned not later than March 17, 1894.
By order,

STEPHEN HOLT,
Clerk.

Offices: Cross Street, Hindley,
Feb. 28, 1894.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office, on Wednesday, the 21st inst., at half-past Twelve o'clock precisely, to transact the usual Business, and to declare the Dividend for the Half Year ended the 31st of December last.
Notice is hereby also given, that the Transfer Books of the Company will be closed on the 10th, and re-opened on the 22nd inst.
By order of the Court of Directors,

FREDERIC LANE LINGING,
Secretary.

Chief Office: 11, George Yard, Lombard Street,
London, E.C., March 2, 1894.

Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.
Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.
*** *The Act extends to Scotland and Ireland.*

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,
(*Established 1851,*)
Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.
SCULCOATS, HULL.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
B Lombard Street, NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly
600,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER PORT GLASGOW."
Established 1872.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the
HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

MEIKLEJOHN'S PATENT

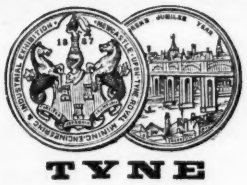
Improved Slide-Valve Anti-Dip

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from

C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL



TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

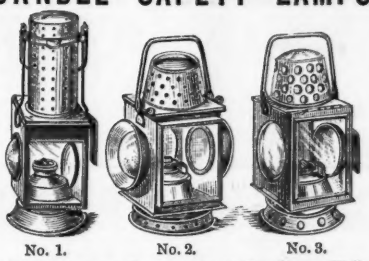
Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

ARMSTRONG'S PATENT

CANDLE SAFETY LAMPS.



No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.
GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

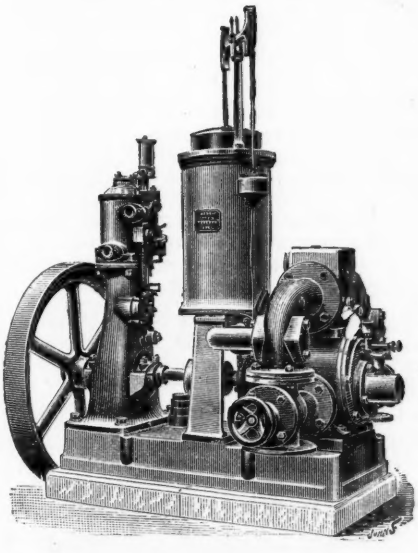
	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.



WALLER'S PATENT COMBINED GAS ENGINE AND EXHAUSTER

WITH

Disc-Valves, Automatic Bye-Pass Valve, Throttle-Valve, and Regulator,

COMPLETE ON ONE BASE PLATE.

Designed chiefly for sizes from 500 to 15,000 feet per hour.

CAN BE SEEN IN ACTION AT ADDRESS BELOW.

EXHAUSTERS OF ANY SIZE

COMBINED WITH GAS-ENGINES (now made to vary in speed).

ENGINES & EXHAUSTERS RUN AT DIFFERENT SPEEDS.

Waller's Washer-Scrubber with Wood Clusters.

ELEVATING AND CONVEYING MACHINERY FOR COAL, COKE, &c.

G. WALLER & CO.,

58, PARK STREET, SOUTHWARK (SURREY SIDE OF SOUTHWARK BRIDGE)

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

To effect a great saving in

GAS-FURNACES use our Special Derbyshire **GANNISTER BRICKS.**

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JAMES WHITE & Co., Limited,

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CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

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TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

TELEGRAPHIC ADDRESS: "ROBUSTNESS, LONDON." EXCHANGE TELEPHONE 1756.

GASEOUS FIRING

FOR LARGE OR SMALL

RETORT-SETTINGS

PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED.

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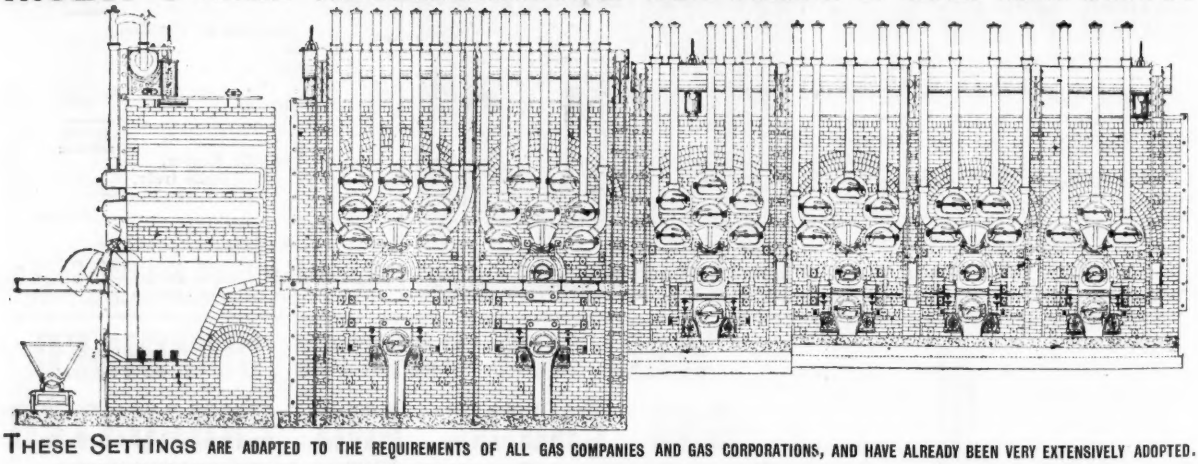
ENGINEERS & CONTRACTORS

FOR THE ERECTION OF GAS AND WATER WORKS COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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Telegraphic Address: "RITCHIE MIDDLESBROUGH."

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Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

John Cowley & Son

MANUFACTURERS OF

SCREWING MACHINES AND GENERAL TOOLS FOR ENGINEERS AND GAS-FITTERS.

SOLE LICENSEES AND MANUFACTURERS OF

"TURNER'S" PATENT TAPPING APPARATUS

FOR DRILLING AND TAPPING GAS, WATER, OR OTHER MAINS UNDER PRESSURE.

ILLUSTRATED LIST ON APPLICATION.

CLARENDON STREET,
HYDE, near Manchester.

TELEGRAPHIC ADDRESS: "COWLEY, HYDE." TELEGRAPH CODE: "A B C, 4TH EDITION."

THE OIL-GAS ENRICHMENT COMPANY, Limited.

Registered Office: 28, Queen Street, Edinburgh. J. GORDON MASON, Solicitor, Secretary.

THE PEEBLES OIL-GAS PROCESS

(YOUNG & BELL'S PATENT.)

R. & J. DEMPSTER, LTD.,

Have made arrangements with the above Company TO ACT AS THEIR AGENTS for the introduction of the process of manufacturing Gas from Oils or Tars, in accordance with the Patent granted to Messrs. Young and Bell, of Peebles, and known as the "PEEBLES PROCESS." They will be pleased to apply the System to any Works, or erect Plant either for the production of Oil Gas for enriching Coal or Water Gas up to any desired Candle Power, or to produce pure Oil Gas of great permanency and high illuminative power, to be used alone in private Mansions or Factories, or under compression in Railway Carriages, &c. They will be pleased to arrange the terms of Royalty, and erect the necessary Apparatus; and for these purposes they invite inquiries from Gas Engineers and others who are disposed to adopt the Process.

Further Particulars may be obtained, and Estimates, &c., will be submitted on application to

R. & J. DEMPSTER, LIMITED,

Gas Plant Works, Newton Heath, MANCHESTER.

Telegraphic Address: "SCRUBBER, MANCHESTER."

London Offices: 181 & 182, Gresham House, Old Broad Street, E.C.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

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CLAYTON SON & Co. LTD.

MAKERS OF

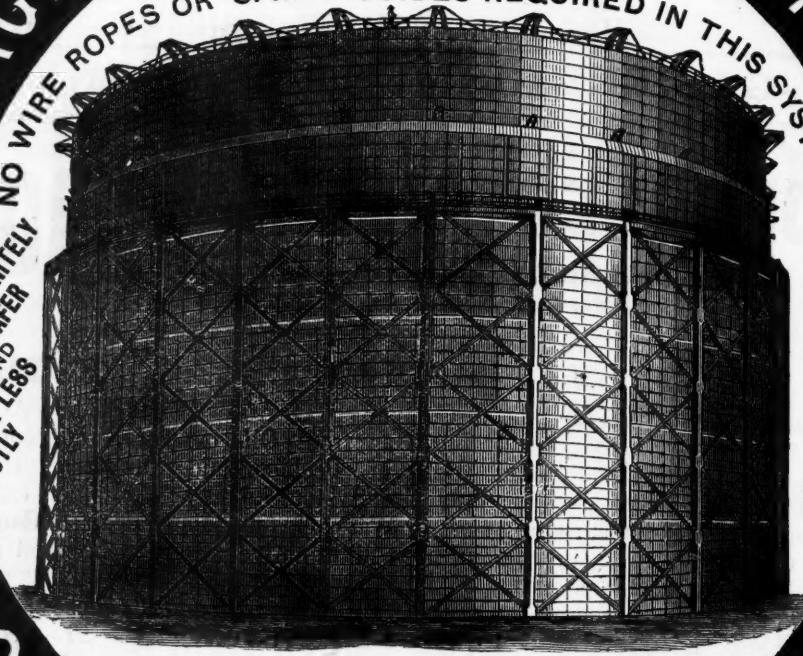
WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.



CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT. DEEP EACH AND IS 300 FT. DIAS.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

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TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

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NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,

Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.

Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Petroleum Ether and Naphtha for clearing the pipes of Naphthalene, &c.

Samples and Prices may be had on application.

ELEVENTH YEAR. Now Ready (Demy 8vo., Price 5s. 6d., post free),

THE COMPLETE REPORTS OF THE PROCEEDINGS

OF THE VARIOUS

DISTRICT ASSOCIATIONS of GAS MANAGERS FOR 1893.

*** **THE TEN PREVIOUS VOLUMES (for 1883 to 1892) ARE STILL ON SALE.**

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IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

HUTCHINSON BROTHERS,

GAS ENGINEERS, &c.,

MANUFACTURERS OF

Improved Wet & Dry Gas-Meters.

STATION-METERS. LAMP-METERS.

Test Gasholders and General Gas Apparatus.

Brass Main & Lamp Taps. Unions, Ferrules, &c.

The "Falcon" Lamplighter's Torch. Service Cleansers.

SYPHON AND OTHER PUMPS.

WOOD AND WROUGHT-IRON PURIFIER-GRIDS. SCRUBBER BOARDS.

WET AND DRY METERS REPAIRED.

FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

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Established 1843.

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PIPE JOINTS,
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RETORT MOUTH-PIECES,
SCRUBBERS,
CONDENSERS,
PURIFIERS,
SIEVES, TANKS,
ENGINES,
BOILERS,
&c., &c.

RIVETS

FOR

GASHOLDERS,
BOILERS,
GIRDERS,
TANKS,
COVERS,
&c., &c.; ALSO
SET SCREWS,
WASHERS,
SPIKES,
AND
FISH-PLATE BOLTS.

Sole Manufacturers of the "PERFECT" Patent LOCK-NUT and WASHER.

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General Superintendent & Chief Engineer,
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Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
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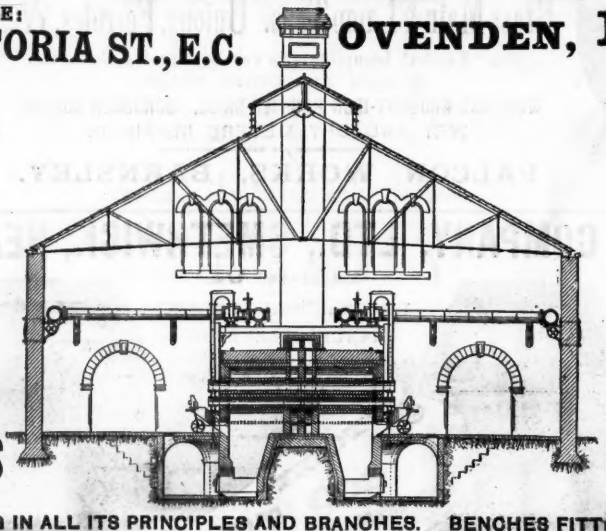

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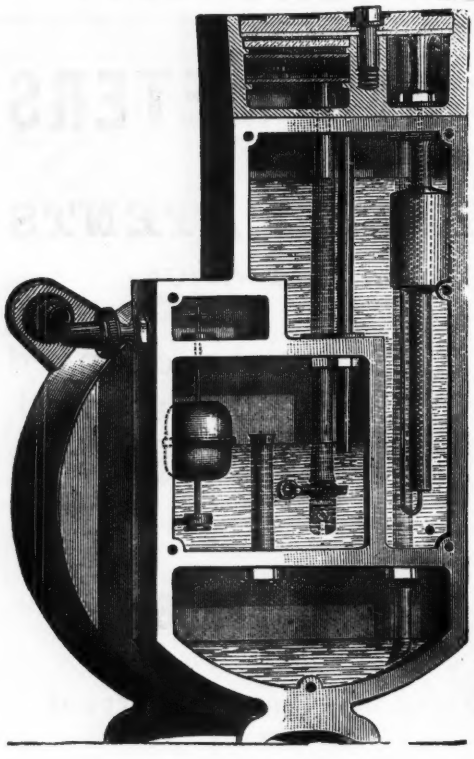

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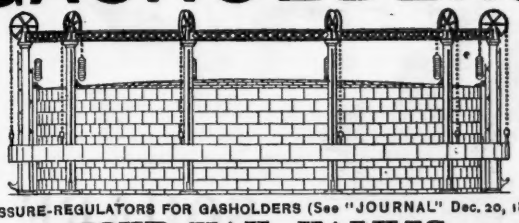

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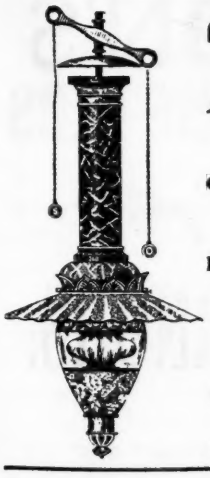

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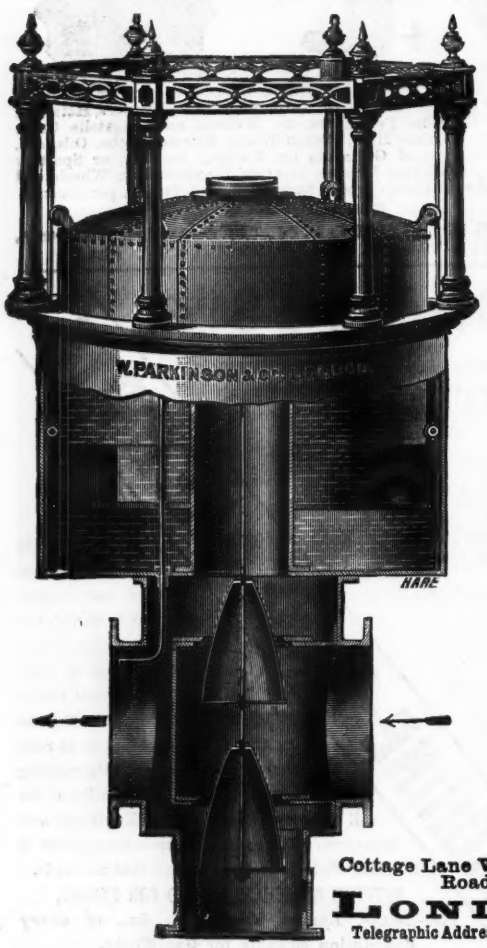

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[See also Advt. p. 424.

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